भारतीय मानक

Indian Standard

IS 10613 : 2023

साइकिल — साइकिलों के लिए सुरक्षा और कार्यकारिता अपेक्षाएं

(तीसरा पुनरीक्षण)

Cycles — Safety and Performance Requirements for Bicycles

(Third Revision)

ICS 43.150

भारतीय मानक ब्यूरो
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Bicycles Sectional Committee, TED 16

FOREWORD

This Indian Standard (Third Revision) was adopted by Bureau of Indian Standards, after the draft finalized by the Bicycles Sectional Committee had been approved by the Transport Engineering Division Council.

This standard was first published in 1983 and revised in 2004 and 2014. This third revision was undertaken on the request of the Bicycle Industry Association as a prerequisite for subsequent migration to minimum mandatory safety requirements with an aim to develop structured manufacturing, fair trade and safer cyclists' eco-system. This apart, to safeguard the Indian bicycle market from becoming a dumping ground for cheaper/substandard bicycles and to make exports globally competitive.

In this revision, the following significant changes have been made:

a) Three more categories of bicycles are included namely; Young Adult Bicycles, Mountain Bicycles and Racing Bicycles;
b) Fatigue, static and impact tests for various bicycle and parts like frame, fork, handle, saddle and pedal etc. incorporated; and
c) Higher load and more number of test cycles for high end or fancy bicycles.

It is expected that compliance of this standard shall ensure that bicycles manufactured will be as safe as is practically possible. The tests have been designed to ensure the strength and durability of individual parts as well as of the bicycle as a whole, demanding high quality throughout and consideration of safety aspects from the design stage onwards. The scope has been limited to safety considerations and has specifically avoided standardization of components.

For the purposes of improving repeatability and reproducibility, and considering the applicability to all types of bicycles and the size and influence of the operator, the machine test method reflects today's state of the art and is preferred to the track test method. Unless evidence of improvement of the test track method in the future, take this method informative.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Not with standing what is stated in this standard, applicable National, State, Local bodies' regulations shall apply. In case of exports corresponding regulations of exporting countries shall apply.

The composition of the technical committee responsible for the formulation of this standard is given at Annex N.

Indian Standard

CYCLES — SAFETY AND PERFORMANCE REQUIREMENTS FOR BICYCLES

1 SCOPE

This standard specifies safety and performance requirements for the design, assembly, and testing of bicycles and sub-assemblies of Young Adult Bicycles with maximum saddle height ranging between 635-750 mm, City and Trekking/Roadster/SLR Bicycles, Mountain Bicycles and Racing Bicycles that have a maximum saddle height of 635 mm or more including folding bicycles (*see* also Table 1 and Fig. 1). It also lays down guidelines for manufacturer's instructions for use and care of such bicycles.

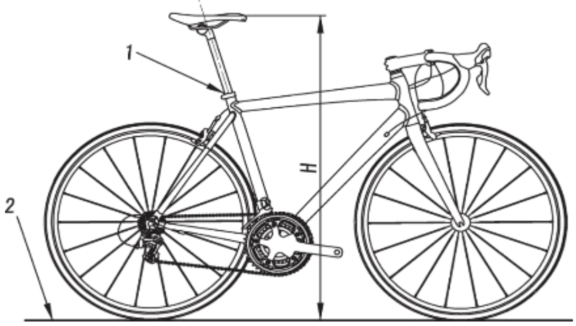
Specialized types of bicycles, such as, Delivery Bicycles, Recumbent Bicycles, Tandems, BMX Bicycles and bicycles designed and equipped for use in severe applications such as sanctioned competition events, stunts or aerobatic are beyond the scope of this standard.

NOTE — For bicycles with a maximum saddle height of 435 mm or less, *see* ISO 8124 -1 and with a maximum saddle height of more than 435 mm and less than 635 mm, *see* IS 15533/ISO 8098.

Table 1 Maximum Saddle Height of Bicycles

(*Clause* 1)

Sl No.	**City and Trekking/Roadster/SLR Bicycles**	**Young Adult Bicycles**	**Mountain Bicycles**	**Racing Bicycles**
(1)	(2)	(3)	(4)	(5)
i)	635 or more	635-750	635 or more	635 or more



All dimensions in millimeters

Key

H Maximum saddle height;

1 Minimum insertion-depth mark; and

2 Ground plane.

FIG. 1 MAXIMUM SADDLE HEIGHT

2 REFERENCES

A list of references, which, through reference in this text, constitute provisions of this standard is provided at Annex A. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards.

3 TERMS AND DEFINITIONS

3.1 Aerodynamic Extension — Extension (or extensions) secured to the handlebar or stem, to improve the rider’s aerodynamic posture.

3.2 Band Brake — Brake in which a circumferential band is wrapped around the exterior of a cylindrical drum which is attached to or incorporated in the wheel-hub.

3.3 Bar End — Extension secured to the end of a handlebar to provide an additional hand grip and usually with its axis perpendicular to the axis of the end of the Handlebar.

3.4 Bicycle — Two-wheeled vehicle that is propelled solely or mainly by the muscular energy of the person on that vehicle, in particular by means of pedals.

3.5 Bolted Joint — Components joined together with threaded fasteners.

3.6 Brake Ever — Lever that operates a braking device.

3.7 Braking Distance — Distance travelled by a bicycle between the commencement of braking and the point at which the bicycle comes to rest.

3.8 Braking Force, F_{BR} — Tangential rearward force between the tyre and the ground, or the tyre and the drum or belt of the test machine.

3.9 City and Trekking/Roadster/SLR Bicycle — Bicycle designed for use on public roads primarily for means of transportation or leisure.

3.10 Commencement of Braking — Point on the test track or test machine at which the brake-actuating device operated directly by the rider’s hand or foot or by a test mechanism starts to move from its rest position. On the test track, the first brake-actuating device (front or rear to operate determines this point.

3.11 Composite Material Component — Component that is entirely or partially made of a non-metallic matrix material which is reinforced by metallic or non-metallic materials such as short or long fibers, fabric, or particles.

3.12 Composite Wheels — Wheel assembly containing any composite material.

3.13 Crank Assembly — Assembly for fatigue testing consisting of the drive side and the non-drive side crank arm, the pedal-spindle adaptors, the bottom-bracket spindle, and the first component of the drive system.

Example:

The Chain-Wheel Set

3.14 Delivery Bicycle — Bicycle designed for the primary purpose of carrying goods.

3.15 Disc Brake—Brake in which pads are used to grip the lateral faces of a thin disc attached to or incorporated in the wheel hub.

3.16 Drive Belt — Seamless ring belt, which is used as a means of transmitting motive force.

3.17 Exposed Protrusion — Protrusion which, through its location and rigidity, could present a hazard to the rider either through heavy contact with it in normal use or should the rider fall onto it, in an accident also it is the protrusion that can be contacted by the central 75 mm of the lateral surface of a cylinder 250 mm long and 83 mm in diameter (simulating a limb) (*see* also Fig.3).

3.18 Dummy Fork — Test fork manufactured to specific characteristics either which can be substituted within a test for the fork supplied by the manufacturer or where a fork has not been supplied.

3.19 Folding Bicycle — Bicycle designed to fold into a compact form, facilitating transport and storage.

3.20 Fracture — Unintentional separation into two or more parts.

3.21 Fork Steerer (Fork Stem) — Part of a fork that rotates about the steering axis of a bicycle frame head tube. It is normally connected to the fork crown or directly to the fork legs and is normally the point of connection between the fork and the handlebar stem.

3.22 Fully Assembled Bicycle — Bicycle fitted with all components necessary for its intended use.

3.23 Highest Gear — Gear ratio which gives the greatest distance travelled for one rotation of the crank.

3.24 Hub Brake — Brake which acts directly on the wheel hub.

3.25 Hub Generator — Electric generating device built in the wheel hub.

3.26 Lowest Gear — Gear ratio which gives the shortest distance travelled for one rotation of the cranks.

3.27 Maximum Inflation Pressure — Maximum tyre pressure recommended by the tyre or rim

manufacturer for a safe and efficient performance. If the rim and tyre both indicate a maximum inflation pressure, the maximum inflation pressure is the lower of the two pressures indicated.

3.28 Maximum Saddle Height — Vertical distance from the ground to the point where the top of the seat surface is intersected by the seat-post axis, measured with the Seat in a horizontal position and with the seat-post set to the minimum insertion-depth mark.

3.29 Minimum Insertion-Depth Mark — Mark indicating the minimum insertion-depth of handlebar stem into fork steerer (fork stem) or seat-post into frame.

3.30 Mountain Bicycle — Bicycle designed for use off-road on rough terrain, on public roads and on public pathways, equipped with a suitably strengthened frame and other components, and, typically, with wide- section tyres with coarse tread patterns and a single or wide range of transmission gears.

3.31 Off-Road Rough Terrain — Coarse pebble tracks, forest trails, and other general off-road tracks where tree roots and rocks are likely to be encountered.

3.32 Pedal Tread Surface — Surface of a pedal that is presented to the underside of the foot.

3.33 Primary Retention System — System that keeps the front/rear wheel securely attached to the frame/fork dropouts while riding.

3.34 Public Pathway — Any designated and adopted road, path, or track on which a Bicycle is legally permitted to travel where motorized traffic is excluded.

3.35 Public Road — Any designated and adopted road, pavement, path, or track on which a bicycle is legally permitted to travel and, on most though not all such public roads, bicycles will share use with other forms of transport including motorized traffic.

3.36 Pulley — Rotating wheel mounted on an axle that contains, around its circumference, teeth or grooves over which a belt can pass to transmit power.

3.37 Quick-Release Device — Lever actuated mechanism that connects, retains, or secures a wheel or any other component.

3.38 Quick-Release Pedal (Clip-Less Pedal) — Pedal that contains a device for the attachment of a rider’s foot/shoe that can be released by foot movement alone.

3.39 Racing Bicycle — Bicycle intended for high-speed use on public roads and having a steering assembly with multiple grip positions (allowing for an aerodynamic posture), a multi-speed transmission system, tyre width not greater than 28 mm and a maximum mass of 12 kg for the fully assembled bicycle.

3.40 Recumbent Bicycle — Bicycle that places the rider in a laid-back reclining position.

3.41 Rim-Brake — Brake in which brake shoes act on the rim of the wheel.

3.42 Screw Thread Locking Devices — Devices attached or applied to the threads of a nut or bolt, so that they do not unintentionally become unlocked e.g., lock washers, lock nuts, thread locking compound or stiff nuts.

3.43 Seat-Post — Component that clamps the saddle (with a bolt or assembly) and connects it with the frame.

3.44 Secondary Retention System — System that retains the front wheel in the fork dropouts when the primary retention system is in the open (unlocked) position.

3.45 Simulated Ground Plane — Plane used to orient a test part or assembly in a way that represents the cycle’s alignment to the ground in a fully assembled cycle.

3.46 Suspension Fork — Front fork incorporating controlled, axial flexibility to reduce the transmission of road shocks to the rider.

3.47 Suspension Frame — Frame incorporating controlled, vertical flexibility to reduce the transmission of road shocks to the rider.

3.48 Tandem — Bicycle with saddles for two or more riders, one behind the other.

3.49 Toe Clip — Device attached to the pedal to grip the toe end of the rider’s shoe but permitting withdrawal of the shoe.

3.50 Visible Crack — Crack which results from a test, wherein that crack is visible to the naked eye.

3.51 Wheel — Assembly or combination of hub, spokes or disc, and rim, but excluding the tyre assembly.

3.52 Wheel Base — Distance between the axis of the front and rear wheels of an unladen Bicycle.

3.53 Young Adult Bicycle — Bicycle designed for use on public roads by a young adult with maximum saddle height ranging between 635-750 mm.

3.54 Tread Surface (Pedal) — It is the surface of a pedal that is presented to the underside of the foot, the design of which incorporates a slip-resistant characteristic.

3.55 Ferrous Component — It is the component, composed of structural members made entirely from ferrous materials excluding any jointing medium such as brazing materials or adhesives.

3.56 Non-Ferrous Component — It is the component, composed of structural members made entirely from non-ferrous materials excluding any joining medium such as adhesives.

NOTE — For the purposes of the choice of fatigue test forces, any component made from a mixture of ferrous and non- ferrous members shall be classified as non-ferrous.

4 REQUIREMENTS OF SUB-ASSEMBLIES

4.1 General

4.1.1 *Sharp Edges*

Exposed edges that could come into contact with the rider's hands, legs, etc, during normal riding or normal handling and normal maintenance shall not be sharp, for example, deburred, broken, rolled, or processed with comparable techniques.

4.1.2 *Toxicity*

All items which come into intimate contact with the rider shall comply with the toxicity requirements as specified in Annex B.

4.1.3 *Protrusions*

These requirements are intended to address the hazards associated with the users of bicycles falling on projections or rigid components (for example, handlebars, levers) on a bicycle possibly causing internal injury or skin puncture. Tubes and rigid components in the form of projections which constitute a puncture hazard to the rider should be protected. The size and shape of the end protection has not been stipulated, but an adequate shape shall be given to avoid puncturing of the body. Screw threads which constitute a puncture hazard shall be limited to a protrusion length of one major diameter of the screw beyond the internally threaded mating part. (*see* Fig. 2)

NOTE — These shall apply when *L* is greater than 8 mm.

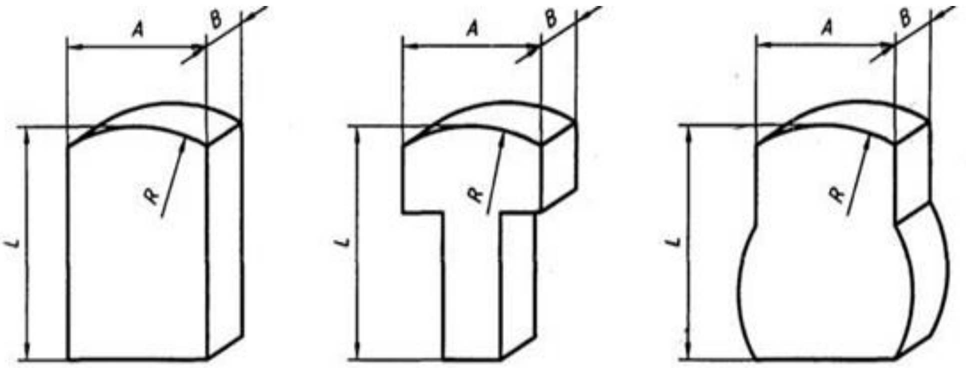


FIG. 2 EXAMPLES OF MINIMUM DIMENSIONS OF EXPOSED PROTRUSIONS

4.1.3.1 *Exposed protrusion*

Any rigid, exposed protrusion shall not exceed 8 mm (*see L* in Fig. 2) after assembly, with the exception of:

a) The front gear-change mechanism at the Chain-wheel;
b) The rear gear-change mechanism below the Chain-stay;
c) The rim- brake mechanism at the front and rear wheels;
d) A lamp-bracket fitted on the head-tube;
e) Reflectors; and
f) Toe-clips and toe straps.

Exposed protrusions shall terminate at a radius, R of not less than 6.3 mm. Such protrusions shall have a major end dimension, A of not less than 12.7 mm and a minor dimension B, of not less than 3.2 mm, (*see* Fig. 2).

4.1.3.2 *Exclusion zone, protective devices and screw threads*

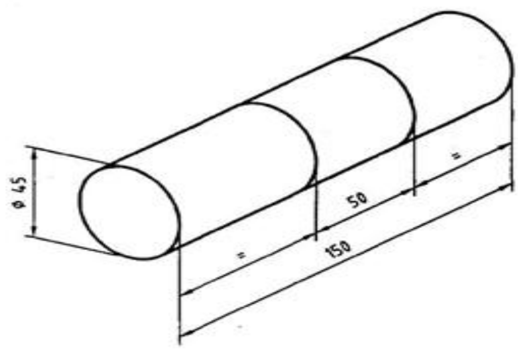
There shall be no protrusions on the top tube of a bicycle frame between the saddle and a point 300 mm forward of the saddle, with the exception that control cables no greater than 6.4 mm in diameter and cable clamps made from material no thicker than 4.8 mm may be attached to the top tube. Foam pads attached to the bicycle frame to act as protective cushions are permitted, provided that the bicycle meets the requirements for protrusions when the pads are removed. A screw thread that is an exposed protrusion shall be limited to a protrusion length of one major diameter of the screw beyond the internally threaded mating part.

4.1.3.3 *Location of exposed protrusions*

The location of exposed protrusions shall be established using a test-cylinder (simulating a limb)

conforming to the dimensions shown in Fig. 3 maneuvers the cylinder in any convenient attitude toward any rigid protrusion on the bicycle. If the central 75 mm long section of the test cylinder comes into contact with any protrusion, that protrusion shall be considered an exposed protrusion and shall comply with the requirements of **4.1.3.1** and **4.1.3.2.**

Examples of exposed protrusions which do, and do not, need to comply with the requirements of **4.1.3.3** are shown in Fig. 4.



All dimensions are in millimeters.

FIG. 3 EXPOSED PROTRUSION TEST CYLINDER

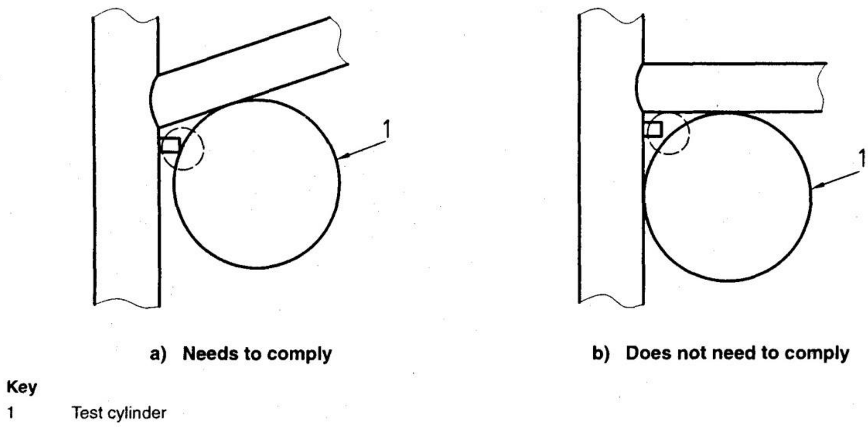


FIG. 4 EXAMPLES OF EXPOSED PROTRUSIONS

4.2 Lighting Systems and Reflectors

4.2.1 *Lighting Systems*

The provision of front or rear lamps, or of a complete lighting system, is not mandatory but where fitted shall comply with the requirements of ISO 6742-1. When a wiring harness is fitted, it shall be positioned to avoid any damage by contact with moving parts or sharp edges. All connections shall with stand a tensile force in any direction of 10 N.

4.2.2 *Reflectors*

These devices shall comply with the provisions in force in the Country in which the product is marketed. If there are no forced provisions of these devices, the Retro-Reflective devices shall comply with the requirements of IS/ISO 6742-2.

4.2.2.1 *Rear reflectors*

A bicycle equipped with a rear light, shall be additionally equipped with a rear wide-angle

reflector, or conventional reflector. A Bicycle that has no such rear light shall be equipped with a wide-angle reflector. Rear reflectors shall be red in colour.

4.2.2.2 *Side reflectors*

A bicycle shall be equipped with two side reflectors each visible from both sides. The reflectors shall be either.

a) Wide angle reflectors fitted on the front half and on the rear half of the bicycle. At least one of these shall be mounted on the spokes of the wheel. Where a bicycle incorporates features at the rear wheel other than the frame and mudguard stays, the moving reflector shall be mounted on the front wheel;

b) A continuous circle of reflective material applied to both sides of each wheel within 10 cm of the outer diameter of the tyre; and

c) All side reflectors shall be of the same colour, either white (clear) or yellow.

4.2.2.3 *Front reflectors*

A bicycle shall be equipped with a front wide-angle reflector of white (clear) in colour.

4.2.2.4 *Pedal reflectors*

Each Pedal shall have reflectors, located on the front and rear surfaces of the pedal. The Reflector elements shall be either integral with the construction of the pedal or mechanically attached, but shall be sufficiently recessed from the edge of the pedal, or of the reflector housing, to prevent contact of the reflector element with a flat surface placed in contact with the edge of the pedal. Pedal reflectors shall be yellow in colour.

4.3 Safety-Related Fasteners

4.3.1 *Security of Screws*

Any screws used in the assembly of Suspension systems, bracket-attached electric generators, Brake mechanisms, and Mudguards to the Frame or Fork, and the Saddle to the Seat-post shall be provided with suitable locking devices, e.g., Lock-washers, Lock-nuts, Thread locking compound, or stiff nuts. Fasteners used in assembly of Hub and Disc brakes should have Heat-Resistant Locking devices.

NOTE — Bolts and Nuts used may be as per IS 1367 (Part 3)/ISO 898-1and IS 1376 (Part 6)/ISO 898-2 respectively.

4.3.2 *Strength of Screws*

The minimum failure Torque of bolted joints for the fastening of Handlebars, Handlebar stems, bar ends, Saddle, and Seat-Posts shall be atleast 50 percent greater than the manufacturer's recommended tightening Torque.

4.4 Brakes

4.4.1 *Braking Systems*

A Bicycle shall be equipped with at least two independently actuated Braking systems. At least one shall operate on the Front Wheel and one on the Rear Wheel. The Braking Systems shall operate without binding and shall be capable of meeting the Braking Performance requirements of **4.4.10.** Brake Blocks containing asbestos shall not be permitted.

4.4.2 *Hand-Operated Brakes*

4.4.2.1 *Brake lever position*

The Brake Levers for Front and Rear Brakes shall be positioned according to the legislation or custom and practice of the country in which the Bicycle is to be sold and the Bicycle manufacturers should state in the manufacturer's instructions which Levers operate the Front and Rear Brakes.

4.4.2.2 *Brake lever grip dimensions*

a) The brake lever similar to type A or type B.

The Dimension '*d*' measured between the outer surfaces of the Brake Lever in the region intended for contact with the rider's fingers and the Handlebar or any other covering present shall cover a distance of not less than 40 mm as shown in Fig. 5 (a) and Fig. 5 (b) and conform to the following:

1) On Bicycles on which the minimum intended height of the Saddle is 700 mm or more, '*d*' shall not exceed 90 mm;

2) On Bicycles on which the minimum intended height of the Saddle is less than 700 mm, '*d*' shall not exceed 75 mm; and

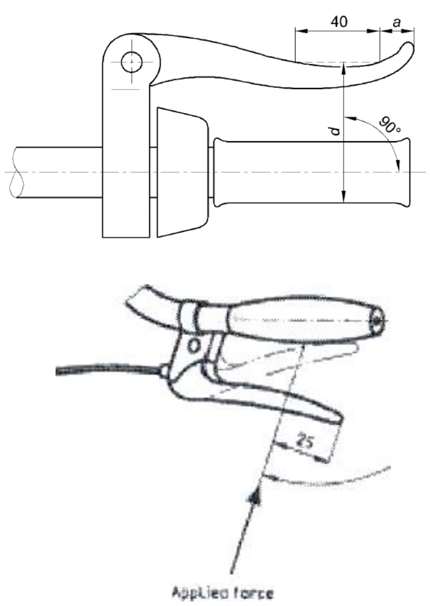
3) The Maximum Grip dimension, d, measured between the outer surfaces of the Brake Lever and the Handlebar, or the Handlebar grip or any other covering where present, shall not exceed 90 mm between points A and B, and 100 mm between points B and C [*see* Fig. 5 (b)].

The range of adjustment on the Brake Lever should permit these dimensions to be obtained. Conformance shall be established by the method detailed in **4.4.3.1.1**; the range of adjustment on the brake lever should permit these dimensions to be obtained.

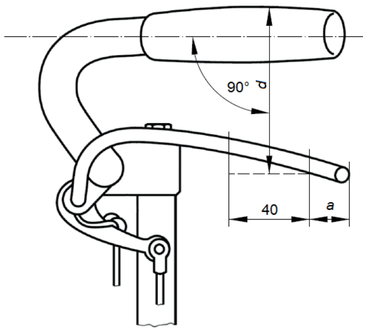
b) The Brake Lever similar to Type C

It shall be possible to fit the dimension gauge shown in Fig. 6 over the Brake Lever (or a secondary brake lever) and the handlebar grip or any other covering in atleast one position between points B and C indicated in Fig. 5 (c), without causing any movement of the Brake Lever towards the Handlebar. The dimension 'd' shall not exceed 100 mm. Conformance shall be established by the

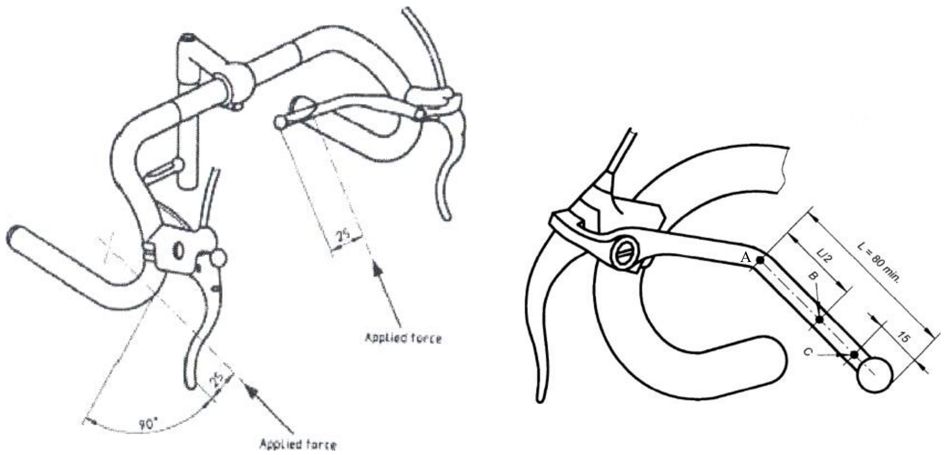
method detailed in **4.4.3.1.2;** the range of adjustment on the Brake Lever should permit these dimensions to be obtained.



a) Type A



b) Type B



c) Type C

Key

1 Pivot;
a Distance between the last part of the Lever intended for contact with the rider's fingers and the end of the Lever;
A Reference point;
B Point of *L*/2;
C Point of 20 mm (in case of an extension Brake Lever, 15 mm) from the end of the lever;
d Brake lever grip dimension; and
L The distance between the center of the lever pivot and the Lever tip end method detailed in **4.4.3.1.2**; the range of adjustment on the brake lever should permit these dimensions to be obtained.

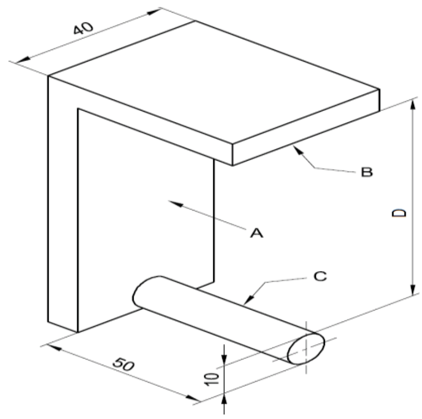
FIG. 5 BREAK LEVER GRIP DIMENSIONS

4.4.*3 Test Method*

4.4.3.1 *Brake lever grip dimensions*

4.4.3.1.1 *Test method for the brake lever similar to type A or type B.*

Fit the gauge illustrated in Fig. 6 over the Handlebar Grip or the handlebar (when the manufacturer does not fit a grip) and the brake lever as shown in Fig.7 so that face A is in contact with the handlebar or grip and the side of the brake lever. Ensure that face B spans an area of that part of the brake lever which is intended for contact with the rider's fingers without the gauge causing any movement of the brake lever towards the handlebar or grip. Measure the distance, *a*, the distance between the last part of the lever intended for contact with the rider's fingers and the end of the lever. The measurement should be conducted only on a fully assembled bicycle.

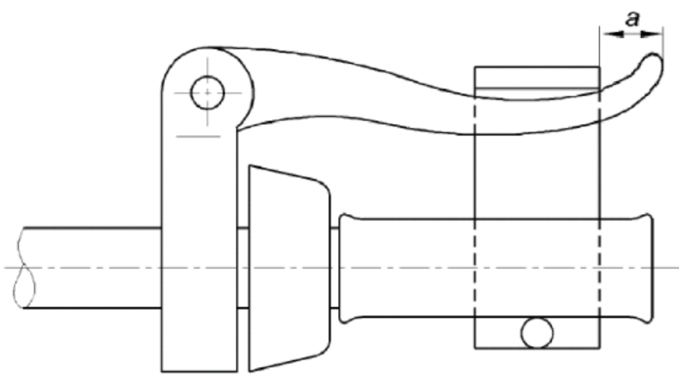


All dimensions are in millimeters

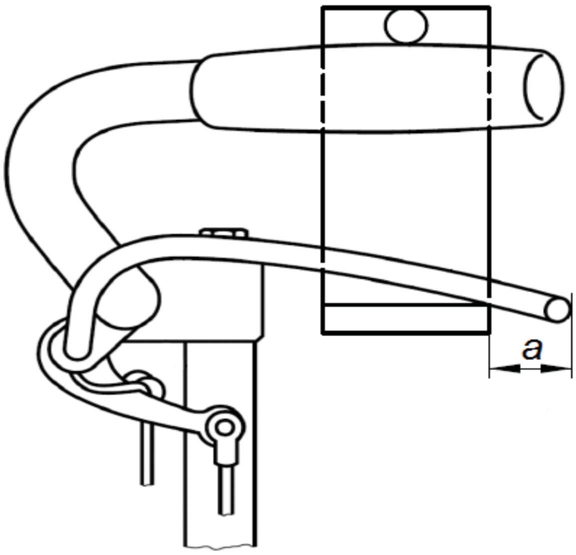
FIG. 6 BRAKE LEVER GRIP DIMENSION GAUGE FOR TYPE A AND TYPE B

Key

A Face A;
B Face B;
C Rod; and
D 75 mm or 90 mm.



a) Type A

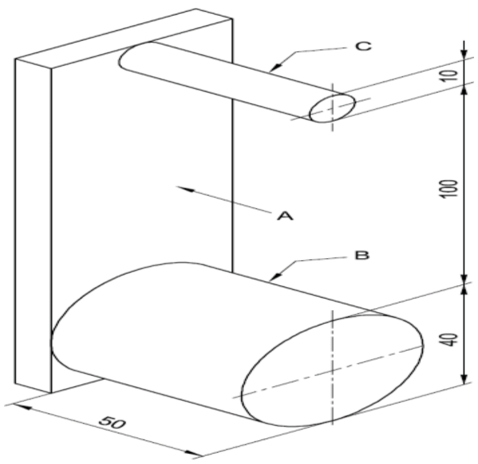


b) Type B

FIG. 7 METHOD OF FITTING THE GAUGE TO THE BRAKE LEVER AND HANDLEBAR

4.4.3.1.2 *Test method for the brake lever similar to type C*

Fit the Gauge illustrated in Fig. 8 over the Handlebar and brake lever as shown in Fig. 9 so that face A is in contact with the Handlebar or Handlebar grip and the brake lever. Put the face of cylinder bin contact with the part of the grip intended for contact with the rider's hand and check if the requirements are met.



Key

A Face A;
B Face of cylinder; and
C Rod.

All dimensions are in millimeters

FIG. 8 BRAKE LEVER GRIP-DIMENSION GAUGE FOR TYPE C

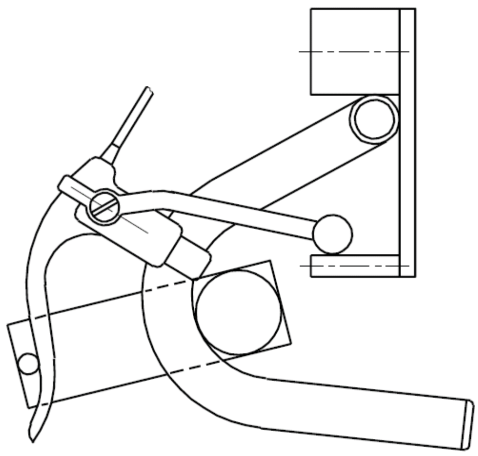


FIG. 9 METHOD OF FITTING THE GAUGE TO THE BRAKE LEVER AND HANDLEBAR FOR TYPE C

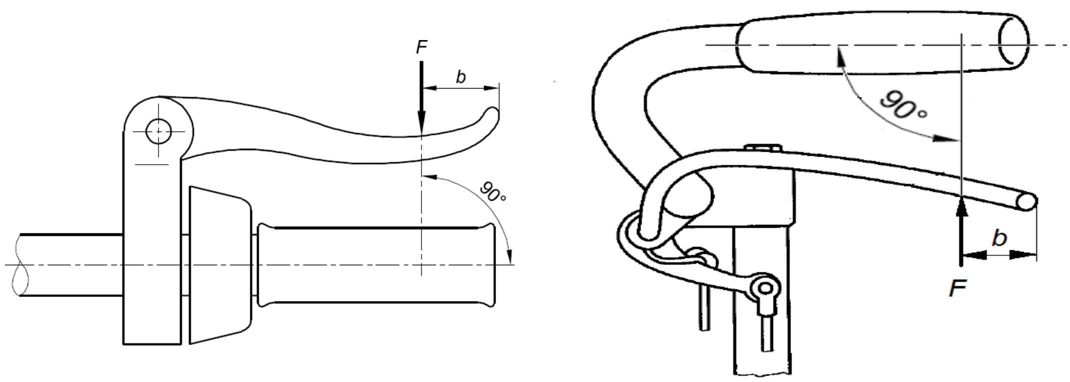
4.4.4 *Brake Levers – Position of Applied Force*

4.4.4.1 *Type A and B brake levers*

For the purposes of braking tests brake levers similar to Type A or Type B, the test force shall be applied at a distance *b*, which is equal to either dimension '*a*' [*see* Fig.5 (a) and (b)] as determined in **4.4 3.1.1** or 25 mm from the free end of the brake lever, whichever is the greater [*see* Fig.10 (a) and (b)].

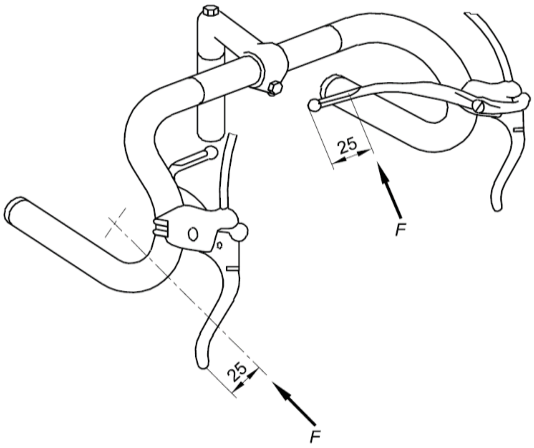
4.4.4.2 *Type C brake levers*

For the purposes of braking tests brake levers similar to Type C, the test force shall be applied at a distance of 25 mm from the free end of the brake lever [*see* Fig. 10 (c)].



a) Type A

b) Type B



c) Type C

Key

F applied force; and
$b \geq 25$ mm.

FIG.10 POSITION OF APPLIED FORCE ON THE BRAKE LEVER

4.4.5 *Attachment of Brake Assembly and Cable Requirements*

Cable pinch bolts shall not sever any of the cable strands when assembled to the manufacturer's instructions. In the event of a cable failing, no part of the brake mechanism shall in advertently inhibit the rotation of the wheel.

The cable end shall either be protected with a cap that shall withstand a removal force of not less than 20 N or be otherwise treated to prevent unraveling. The screws used to attach a brake assembly to the Frame; Fork or Handlebar shall be provided with suitable locking devices, for example, a Lock-washer, Lock-nut or Stiff-nut.

4.4.6 *Brake-Block and Brake-Pad Assemblies — Security Test*

The friction material shall be securely attached to the holder, backing plate, or shoe and there shall be no failure of the braking system or any component thereof, and the brake shall meet the performance requirements of **4.4.10** when tested by the method specified in **4.4.6.1.**

4.4.6.1 *Test method*

Conduct the test on a fully assembled bicycle with the brakes adjusted to a correct position with a Rider or equivalent mass on the Saddle. The combined mass of the bicycle and rider (or equivalent mass) shall be 100 kg.

Actuate each brake lever with a force of 180 N applied at the point specified in Fig. 10 or a force sufficient to bring the brake lever into contact with the Handlebar grip, whichever is lesser. Maintain this force while subjecting the bicycle to five forward and five rearward movements, each of which is not less than 75 mm distance.

Then conduct the test described in **4.4.8.1** or **4.4.9.2** as appropriate, depending on the style of brake, and then the test described in **4.4.10.**

4.4.7 *Brake Adjustment*

Each brake shall be equipped with an adjustment mechanism, either manual or automatic. Each brake shall be capable of adjustment with or without the use of a tool to an efficient operating position until the friction material has worn to the point of requiring replacement as recommended in the manufacturer's instructions. Also when correctly adjusted, the friction material shall not contact anything other than the intended braking surface.

The brake blocks of a bicycle with rod brakes shall not come into contact with the rim of the Wheels when the steering angle of the handlebars is set at 60°, nor shall the rods bend, or be twisted after the Handlebars are reset to the central position.

4.4.8 *Hand-Operated Braking-System — Strength Test*

When tested by the method described in **4.4.8.1**, there shall be no failure of the braking system or of any component thereof.

4.4.8.1 *Tests method*

Conduct the test on a fully assembled bicycle. After it has been ensured that the braking system is adjusted according to the recommendations in the manufacturer's instructions, apply a Force to the brake lever at the point specified in Fig. 10. This force shall be 450 N, or such lesser force as is required to bring

a) A brake lever into contact with the handlebar grip or the handlebar where the manufacturer does not fit a grip;

b) A brake extension lever level with the surface of the handlebar or in contact with the handlebar; and

c) A secondary brake lever to the end of its travel.

d) Repeat the test 10 times on each brake lever, secondary brake lever, or extension Lever.

4.4.9 *Back-Pedal Braking System — Strength Test*

4.4.9.1 *General*

If the back-pedal braking system is fitted, the brake shall be actuated by the operator's foot applying force to the Pedal in a direction opposite to that of the drive force. The brake mechanism shall function regardless of any drive gear positions or adjustments. The differential between the drive and brake positions of the Crank shall not exceed 60°. The measurement shall be taken with the crank held against each position with a pedal force of at least 250 N. The force shall be maintained for 1 minute in each position. The brake shall be actuated by the operator's foot applying force to the pedal in a direction opposite to that of the Drive force. The brake mechanism shall function independently of any drive-gear positions or adjustments. The differential between the drive and brake positions of the Crank shall not exceed 60°. The measurement shall be taken with the crank held against each position with a torque of at least 14 Nm.

4.4.9.1.1 *Requirement*

When tested in accordance with **4.4.9.2** there shall be no failure of the brake system or any component thereof.

4.4.9.2 *Test method*

Conduct the test on a fully assembled bicycle. After it has been ensured that the braking system is adjusted, and with the Pedal cranks in a horizontal position, as shown in Fig. 11, apply a vertically downward force to the center of the left-hand Pedal spindle. Increase the force progressively to 1 500 N and maintain fully for 1 minute.

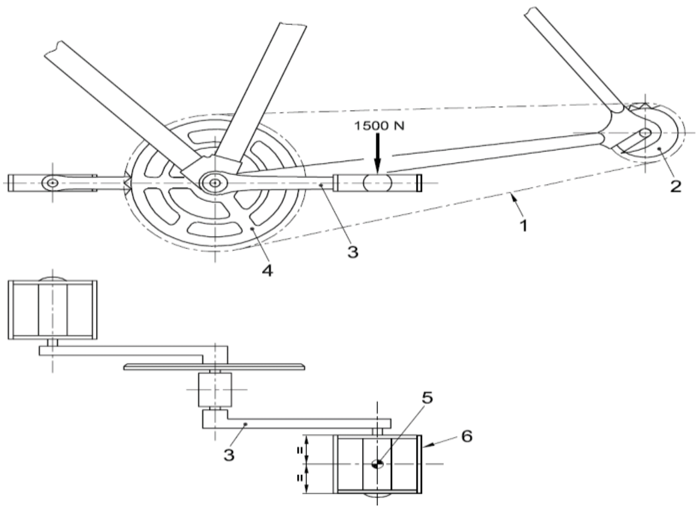


FIG. 11 BACK-PEDAL BRAKE TEST

Key
1 Chain;
2 Hub sprocket;
3 Non-drive side crank;
4 Cycle chain wheel and pedal crank;
5 Point of force application; and
6 Pedal

4.4.10 *Braking Performance*

4.4.10.1 *General*

Two test methods are specified to determine braking performance and experience has shown that either method is suitable and either can be used. One test method is the track test in which braking distance is measured directly with the progressive characteristics of the brakes being self-evident. The alternative test method is a machine/rig base test in which braking force is measured and, from which, braking performance values are calculated. The progressive characteristics of the brake are determined by linearity measurements. A final, simple track test checks for smooth, safe, stopping characteristics.

Whichever method is used, there shall be compliance with **4.4.10.2** or **4.4.12.** *See* **4.4.13.7 (h)** Test Method — Simple track test.

4.4.10.1.1 *Test bicycle*

Conduct the braking Performance test on a fully assembled bicycle after the brakes have been subjected to Strength test detailed in **4.4.8** and **4.4.9**. Before testing the bicycle by either method, inflate the tyres and adjust the brakes according to the manufacturer's instructions. In the case of rim-brakes, adjust it to the maximum clearance specified by the manufacturer.

4.4.10.1.2 *Secondary brake levers*

Where a bicycle is fitted with secondary brake levers attached to brake levers, bar-ends, or aerodynamic extensions, separate tests shall be conducted for the operation of the secondary brake levers in addition to tests with the normal levers. Where a bicycle is fitted with extension levers, separate tests shall be conducted for the operation of the extension levers. In addition to tests using the normal levers to which the extensions are attached.

4.4.10.2 *Track test*

When tested in accordance with **4.4.10.2.1**, the bicycle shall fulfill the requirements shown in Table 2.

Table 2 Brake Test Velocities and Braking Distances
(*Annexes* 4.4.10.2, 4.4.10.7, 4.4.10.11 *and* 4.4.10.12)

Sl No.	**Bicycle type**	**Condition**	**Velocity** (km/h)	**Brake in Use**	**Maximum Corrected Braking Distance,** (m)
(1)	(2)	(3)	(4)	(5)	(6)
i)	City and trekking and roadster/SLR bicycles	Dry	25	Both	7
				Rear only	15
		Wet	16	Both	5
				Rear only	10
ii)	Young adult bicycles	Dry	25	Both	7
				Rear only	15
		Wet	16	Both	5
				Rear only	10
iii)	Mountain bicycles	Dry	25	Both	6
				Rear only	10
		Wet	16	Both	5
				Rear only	10
iv)	Racing bicycles	Dry	25	Both	6
				Rear only	12
		Wet	16	Both	5
				Rear only	10

4.4.10.2.1 *Track test method*

a) Use an indoor test track if possible. If an outdoor test track is used, pay special attention to ambient conditions throughout the test;

b) The gradient of the track shall not exceed 0.5 percent. If the gradient is less than 0.2 percent carryout all runs in the same direction. If the gradient lies between 0.2 percent and 0.5 percent, carry out alternate runs in opposite directions;

c) The surface shall be hard, of concrete or

fine asphalt, and free from loose dirt or gravel. The minimum coefficient of friction between the dry surface and the bicycle tyre shall be 0.75;

d) The track shall be essentially dry at the commencement of tests. When testing to the requirements of **4.4.10.7**, the track shall remain dry throughout the tests; and

e) The wind speed on the track shall not exceed 3 m/s during the tests.

4.4.10.3 *Instrumentation*

The test bicycle or the test track shall be instrumented to include the following:

a) A calibrated Speedometer or Tachometer (accurate to within ± 5 percent) to indicate to the rider the approximate speed at the commencement of Braking;

b) A velocity-recording device (accurate to within ± 2 percent) to record the velocity at the commencement of braking;

c) A distance recording system (accurate to within ± 1 percent) to record the braking distance;

d) A water spray system, to provide wetting of the braking surface, consisting of a water reservoir connected by tubing to a pair of nozzles at the front wheel and a pair of nozzles at the rear wheel. A quick-acting on/off valve shall be included for control by the rider. Each nozzle shall provide a flow of water at ambient temperature of not less than 4 ml/s. Details of the positions and directions of nozzles for rim brakes, hub brakes, band brakes, disc brakes, and back-pedal brake are given in Fig. 12 to 18; and

e) A brake-actuation indicating system to record independently when each lever or pedal is actuated. Fig.12 and Fig.13 for rim brakes show side-pull calipers but the same arrangements apply to center-pull calipers and cantilever brakes.

4.4.10.4 *Mass of bicycle, rider and instrumentation*

a) The combined mass of the bicycle, the rider, and the instrumentation shall be 100 kg;

b) When wet condition braking tests are performed, the combined mass can decrease throughout the test due to water consumption, but it shall not be less than 99 kg at the end of the valid test runs;

c) Where a manufacturer specifies that their bicycle can carry a mass such that the sum of that mass plus the mass of the bicycle is in excess of 100 kg (60 kg for young adults) to some value ‘M’ apply ‘M’ as total weight.

d) Any extra weight shall be positioned above the rear wheel and in front of the rear axle.

4.4.10.5 *Force applied to the brake levers*

a) Magnitude and position of force on brake levers.

Apply a handgrip force not exceeding 180 N at the point as specified in Fig. 10. Check before and after each series of test runs to verify the lever force.

b) Optional brake-force application device.

It is permissible to use a test mechanism to operate the brake lever, and when such a device is used, it shall meet the requirements of (a) above and shall additionally control the rate of application of the brake lever force such that 63 percent of the intended lever force is applied in not less than 0.2 s.

4.4.10.6 *Running — In the braking surfaces*

A running-in process shall be conducted on every brake before performance testing is carried out. Apply the Brakes for not less than 3 s to maintain steady deceleration while the bicycle is being ridden at a speed of approximately 16 km/h. Repeat this operation 10 times.

4.4.10.7 *Test method — Test runs under dry conditions*

Pedal the test bicycle until the specified test velocity is attained (*see* Table 2). Then stop pedaling and apply the brakes. The bicycle shall be brought to a smooth, safe stop [*see* **4.4.14** (a)].

4.4.10.8 *Test method — Test runs under wet conditions*

The method given in **4.4.10.7**, with the addition that wetting of the brake system shall commence not less than 25 m prior to the commencement of braking and shall continue until the bicycle comes to rest. Excessive amounts of water can be swept from the test track surface between runs.

4.4.10.9 *Number of valid test runs*

If the gradient of the track is less than 0.2 percent, the following runs shall be made:

a) Five consecutive valid runs under dry conditions.

b) Two acclimatization runs under wet conditions (results not recorded).

c) Five consecutive valid runs under wet conditions.

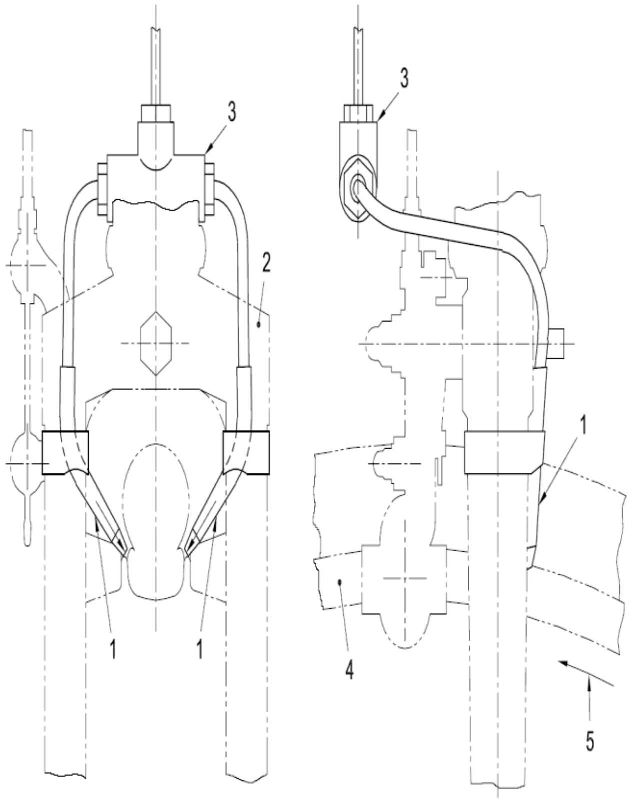
If the gradient of the track lies between 0.2 percent and 0.5 percent, the following runs shall be made:

d) Six consecutive valid runs under dry conditions with alternate runs in opposite directions.

e) Two acclimatization runs under wet conditions (results not recorded).

f) Six consecutive valid runs under wet conditions with alternate run in opposite directions.

A rest period not exceeding 3 minute can be taken between successive runs.

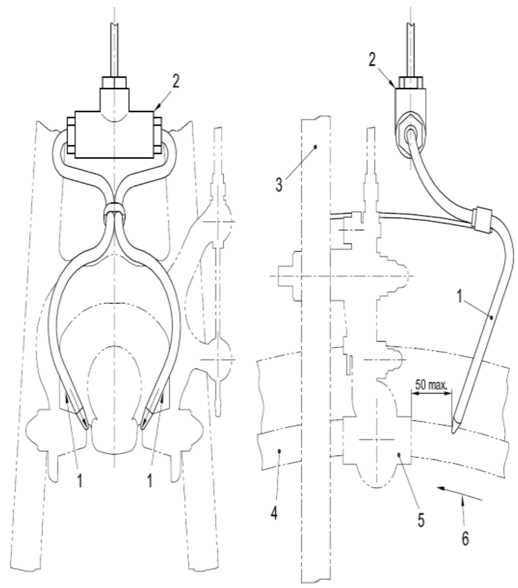


Key

1 Water nozzles;
2 Fork crown;
3 Front tee-piece;
4 Wheel rim; and
5 Direction of the wheel rotation.

All dimensions are in millimeters

FIG. 12 WATER NOZZLES FOR RIM-BRAKE (FRONT)



Key

1 Water nozzles;

2 Rear tee-piece;

3 Bicycle frame;

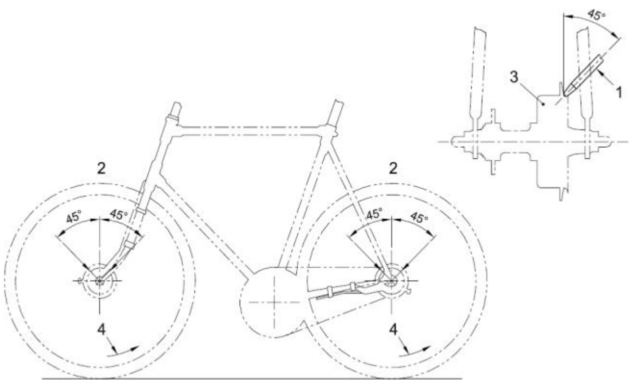
4 Wheel rim;

5 Brake assembly; and

6 Direction of the wheel rotation.

All dimensions are in millimeters

FIG.13 WATER NOZZLES FOR RIM-BRAKE (REAR)



Key

1 Water nozzle;

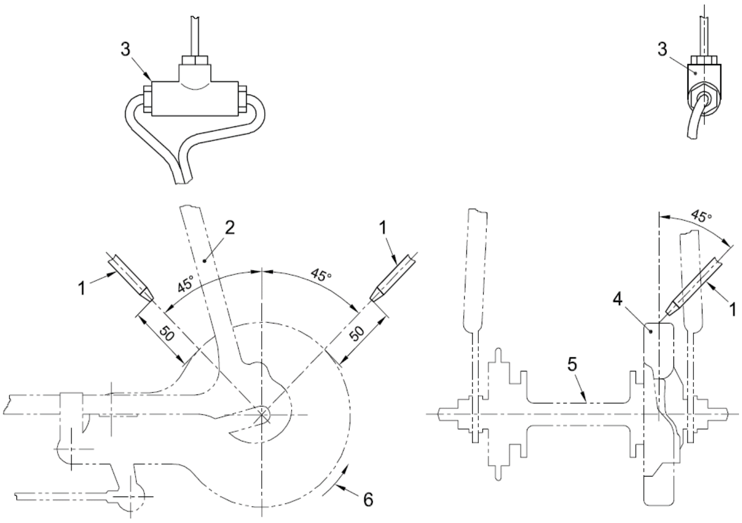
2 Two water nozzles;

3 Hub brake; and

4 Direction of the wheel rotation.

All dimensions are in millimeters

FIG. 14 WATER NOZZLES FOR HUB-BRAKE.

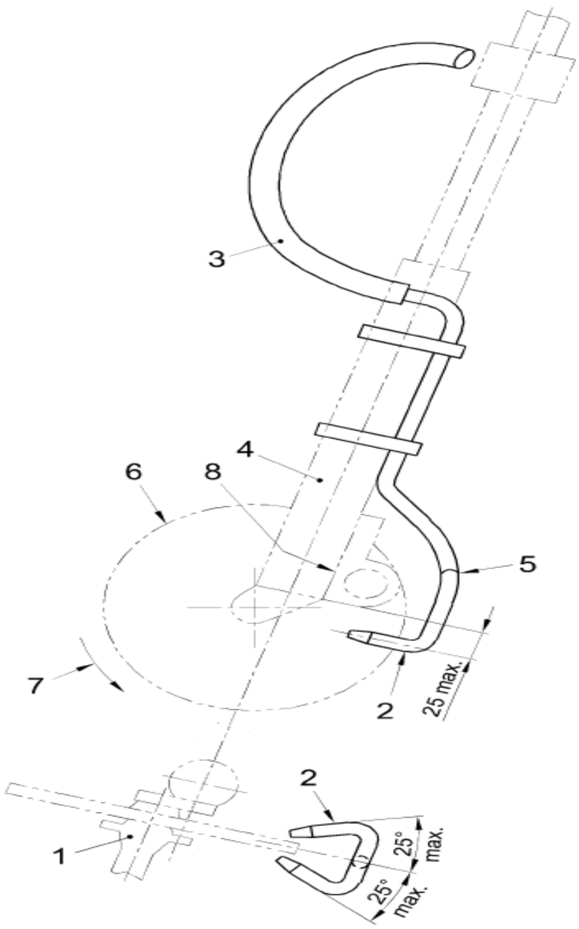


Key

1 Water nozzle;
2 Bicycle Frame;
3 Rear tee-piece;
4 Band brake
5 Rear hub; and
6 Direction of the wheel rotation.

All dimensions are in millimeters

FIG.15 WATER NOZZLES FOR BAND-BRAKE

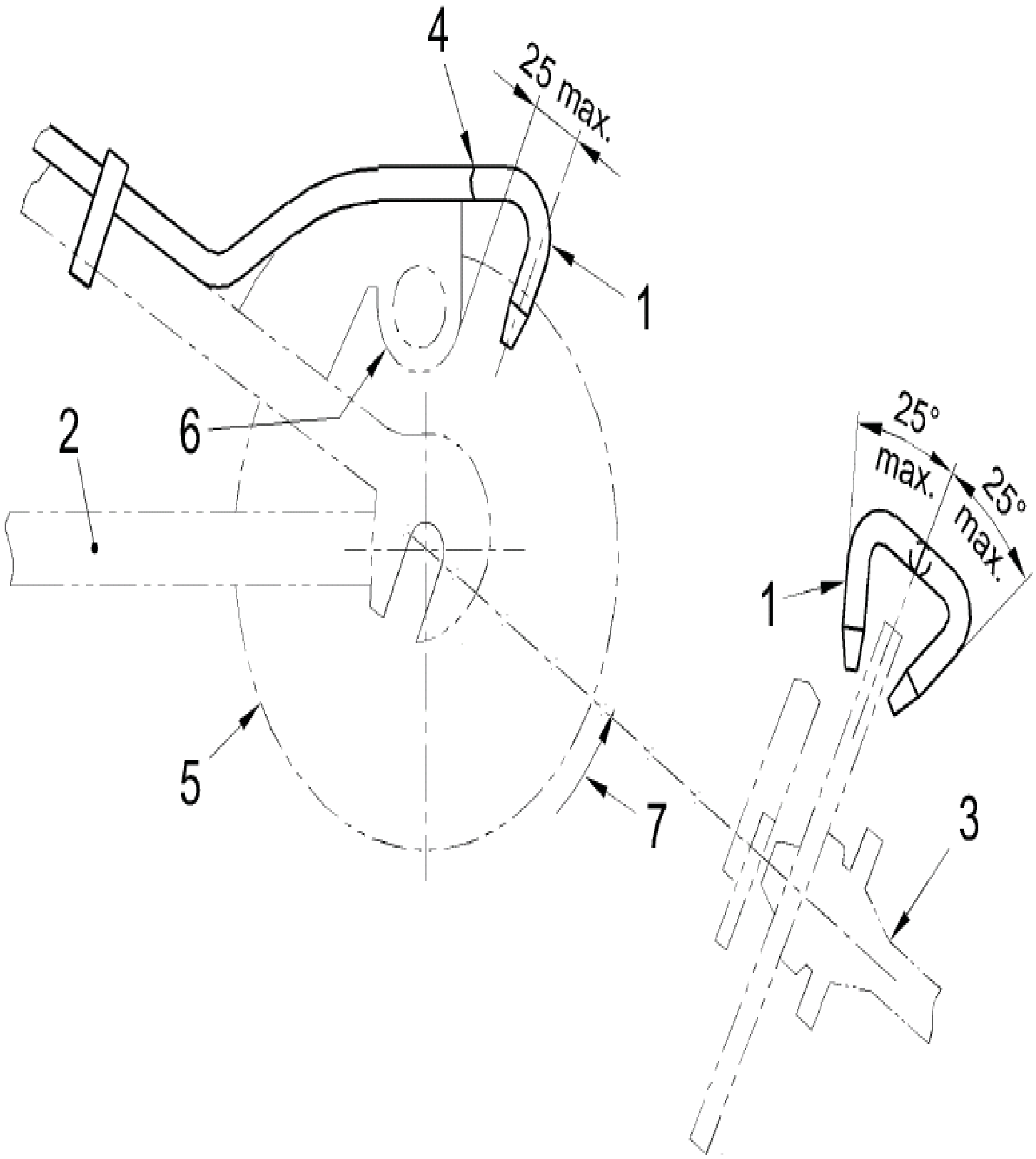


Key

1 Front hub;
2 Water nozzles;
3 Flexible pipe;
4 Suspension-fork leg;
5 Y-joint;
6 Brake-disc;
7 Direction of the wheel rotation; and
8 Disc-brake caliper.

All dimensions are in millimeters

FIG. 16 WATER NOZZLES FOR DISC-BRAKE (FRONT)

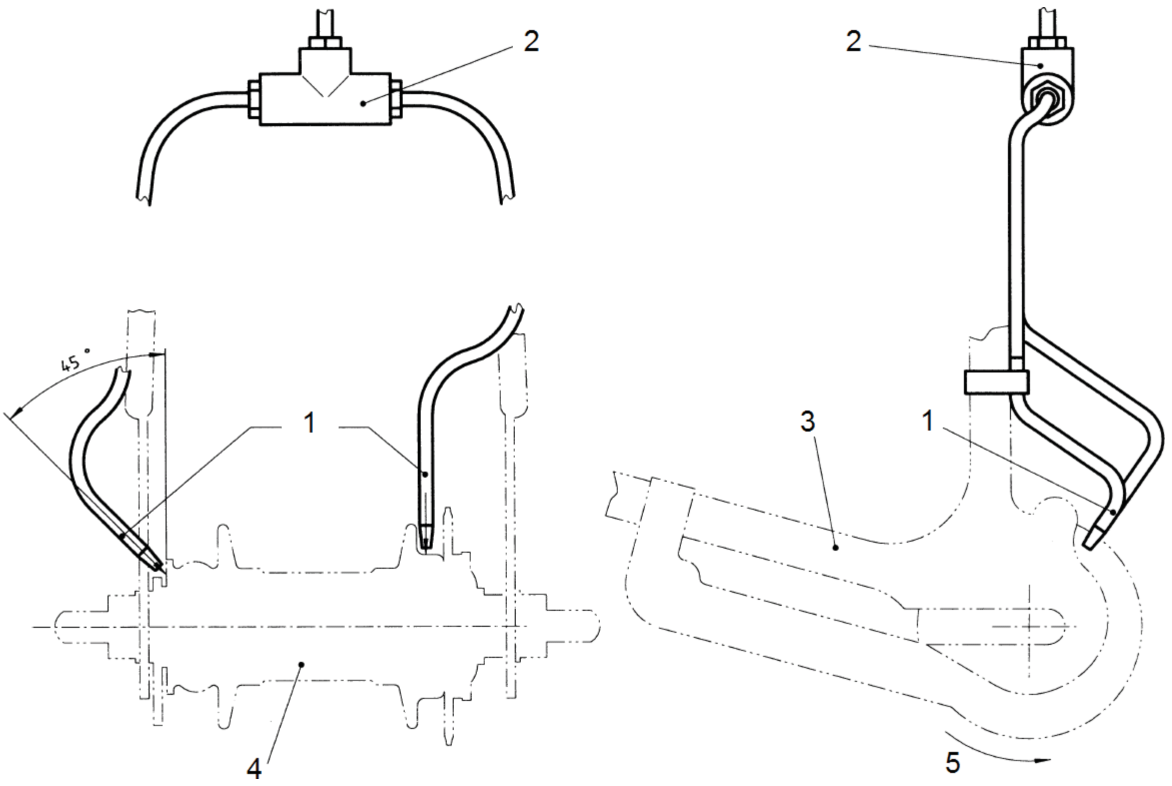


Key

1 Water nozzles;
2 Bicycle frame;
3 Rear hub
4 Y-joint;
5 Brake disc;
6 Disc-brake Caliper; and
7 Direction of the wheel rotation.

All dimensions are in millimeters

FIG. 17 WATER NOZZLES FOR DISC-BRAKE (REAR)



Key
1 Water nozzles;
2 Rear tee-piece;
3 Bicycle frame;
4 Brake hub; and
5 Direction of the wheel rotation.

FIG. 18 WATER NOZZLES FOR BACK-PEDAL BRAKE

4.4.10.10 *Velocity/distance correction factor*

A correction factor shall be applied to the measured Braking distance if the velocity as checked by the timing device is not precisely as specified in **4.4.10.2**.

The corrected braking distance shall be determined from formula (1):

$$S_c = [\frac{Vs}{Vm}]^2 \times S_m$$

where

S_c = Corrected Braking distance (m);
V_s = Specified test velocity (m/s);
V_m = Measured test velocity (m/s); and
S_m = Measured Braking distance (m);

4.4.10.11 *Validity of test runs*

A test run shall be considered invalid if:

a) Side-skid causing the rider to put his foot to the ground to retain control occurs; and

b) Loss of control occurs.

With certain types of braking system, it might not be possible to avoid entirely some skidding of the Rear Wheel during braking. This is considered acceptable provided that (a) or (b) above do not occur as a result.

If the corrected braking distance exceeds the Braking distance specified in Table 2, a test run shall be considered invalid if the velocity at the commencement of the test exceeds the specified test velocity by more than 1.5 km/h as specified in Table 2. If the corrected braking distance is less than the braking distance specified in Table 2, a test run shall be considered invalid if the velocity at the commencement of braking is more than 1.5 km/h below the specified test velocity. If the corrected Braking distance exceeds the braking distance specified in Table 2, the test run shall be considered valid.

4.4.10.12 *Test results*

a) Braking under dry conditions

Depending on the gradient of the test track, the test result shall be the average value of the corrected Braking distance (*see* **4.4.10.10)** of the test results of either **4.4.10.9** (a) or **4.4.10.9** (d) . For compliance with the requirements of **4.4.10.2** the above average values shall not exceed the relevant Braking distances specified in Table 2.

b) Braking under wet conditions

Depending on the gradient of the Test Track, the test result shall be the average value of the corrected Braking distances (*see* **4.4.10.10**) of the test results of either **4.4.10.9** (c) or **4.4.10.9** (f). For compliance with the requirements of **4.4.10.2** the above average values shall not exceed the relevant Braking distances specified in Table 2.

c) Ratio between wet and dry braking performance for city and trekking/roadster/ SLR, young adult and mountain bicycles because the wet and dry braking distances are measured at different test velocities, a simple comparison of braking distances is not meaningful. Therefore, a comparison shall be made of equivalent, calculated values, using formula (2):

$$\frac{16^2}{S_C w} : \frac{25^2}{S_C D}$$

where

$S_C w$ = Corrected braking distance in wet conditions (m); and

$S_C D$ = Corrected braking distance in dry conditions (m).

4.4.11 *Back-pedal brake linearity test*

This test shall be conducted on a fully assembled Bicycle. The output force for a Back-Pedal Brake shall be measured tangentially to the circumference of the rear tyre, when the wheel is rotated in the direction of forward movement, while a force of between 90 N and 300 N is being applied to the pedal at right angles to the crank and in the direction of braking.

The braking force reading shall be taken during a steady pull and after one revolution of the wheel. A minimum of five results, each at a different pedal force level, shall be taken. Each result shall be the average of three individual readings at the same load level.

The results shall be plotted on a graph, showing the line of best fit and the ± 20 percent limit lines obtained by the method of least squares outlined in Annex C.

4.4.12 *Machine Test*

When tested in accordance with **4.4.13**, the bicycle shall fulfill the requirements shown in Table 3.

Table 3 Calculated Braking Performance Value
(*Clause* 4.4.12)

Sl No.	Bicycle Type	Condition	Brake in Use	Minimum Braking Performance value, Bp (N)
(1)	(2)	(3)	(4)	(5)
i)	City and trekking and roadster or SLR bicycles	Dry	Front only	340
			Rear only	220
		Wet	Front only	220
			Rear only	140
ii)	Young adult bicycles	Dry	Front only	204
			Rear only	132
		Wet	Front only	132
			Rear only	84
iii)	Mountain bicycles	Dry	Front only	425
			Rear only	280
		Wet	Front only	220
			Rear only	140
iv)	Racing bicycles	Dry	Front only	425
			Rear only	260
		Wet	Front only	220
			Rear only	140

4.4.13 *Machine Test Method*

4.4.13.1 *General*

4.4.13.2 *Symbols*

Fop — Operating force (that is, force applied on brake lever or pedal).

Fop intend — intended operating force (for example, 40 N, 60 N, 80 N etc).

Foprec — recorded operating force (for example, 38 N, 61 N, 79 N etc).

FBr — Braking force.

FBrrec — Recorded braking force.

4.4.13.3 *Linearity*

When tested by the methods described in **4.4.13.7** c) (i) and (ii), the Braking Force FBr average shall be linearly proportional (within ± 20 percent) to the progressively increasing intended operating forces Fop intend. The requirement applies to braking forces FBr average equal to and greater than 80 N (*see* Annex B).

The test machine enables the braking distances for both brakes and the rear brake alone to be calculated from measurements of the individual braking forces of the front and rear brakes on a drum or belt.

FBr corr — Corrected braking force (Corrected for difference between Fop intend and Foprec.)

FBr average — Arithmetic mean of the three FBr corr at one level of Fop intend.

FBr max — Maximum FBr average.

F^DBr — Dry braking force.

F^WBr — Wet braking force.

4.4.13.4 *Test machine*

The test machine shall incorporate a system that drives the Wheel during the test by tyre contact and a means of measuring the braking force, and typical examples of two types of machines are illustrated in Fig. 19 and 20.

Fig. 19 shows a machine in which a roller drives the

individual wheels, and Fig. 20 shows a machine in which a driven belt contacts both wheels. Other types of machines are permitted, provided they meet the specific requirements listed below and those specified in **4.4.13.5** and **4.4.13.6**.

The specific requirements are as follows:

a) The linear surface velocity of the tyre shall be 12.5 km/h and shall be controlled within ± 5 percent;

b) A means of laterally restraining the wheel under test shall be provided which does not influence the measurement of braking force;

c) A means of laterally applying forces to the brake levers at the point specified in Fig. 10 shall be provided, with the width of the contact on the lever not greater than 5 mm. In the case of back-pedal brakes, a means of applying forces to a pedal is also required.

4.4.13.5 *Instrumentation*

The test machine shall be instrumented to include the following:

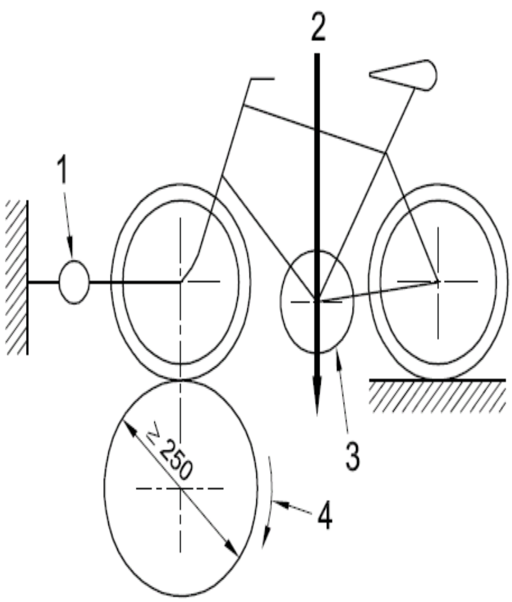
a) A device to record the surface velocity of the tyre, accurate to within ± 2 percent;

b) A device to record the braking force (*see* Fig. 19 and 20, for example), accurate to within ± 5 percent;

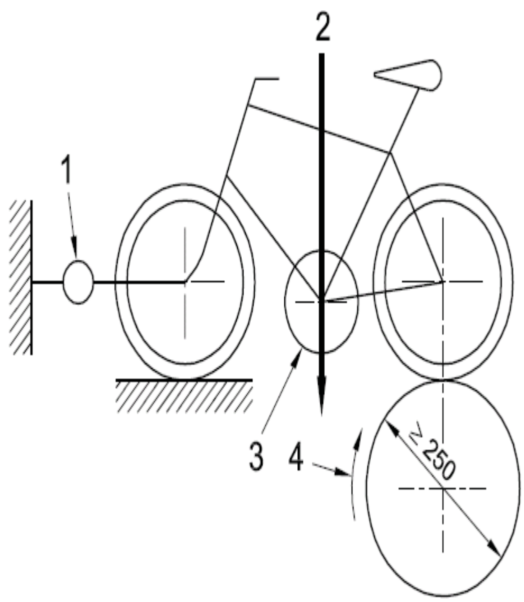
c) A device to record the operating force applied to the hand lever or pedal, accurate to within ± 1 percent;

d) A water spray system, to provide wetting of the brakes of the bicycle, consisting of a water reservoir connected by tubing to a pair of nozzles arranged as shown in Fig 21. Each nozzle shall provide a flow of water at ambient temperature of not less than 4 ml/s. The wheel shall be suitably enclosed to ensure that, in addition to the rim, any hub or disc-brake is thoroughly wetted before a test begins; and

e) A system for loading the wheels of the bicycle against the driving mechanism (*see* **4.4.13.6**).



a) Testing the front brake



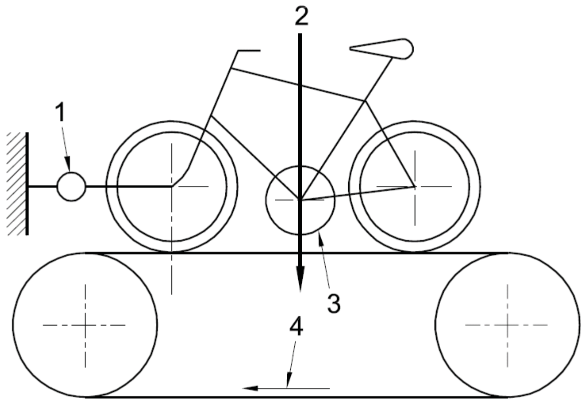
b) Testing the rear brake

All dimensions are in millimeters

Key

1 Braking force transducer;
2 Applied force;
3 Additional mass; and
4 Direction of drum rotation.

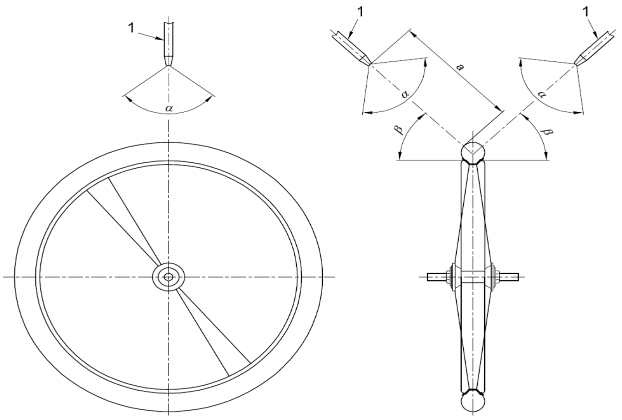
FIG. 19 BRAKING PERFORMANCE TEST MACHINE — SINGLE DRUM TYPE



Key

1 Braking force transducer;
2 Applied force;
3 Additional mass; and
4 Direction of belt travel.

FIG. 20 BRAKING PERFORMANCE TEST MACHINE — DRIVEN BELT TYPE



Key

α 90° to 120°;

β 30° to 60°;

a 150 mm to 200 mm; and

1 Water nozzles.

NOTE — Applicable to all types of brake

FIG. 21 WATER NOZZLE ARRANGEMENT FOR THE WET BRAKING TEST

4.4.13.6 *Vertical force on the tested wheel*

The wheel to be tested shall be forced vertically downwards so that no skidding of the wheel occurs when tested according to **4.4.13.7**(c) (i) and (ii). The necessary force can be applied anywhere on the bicycle (wheel axle, bottom bracket, seat-post, etc) provided that it is exerted vertically downwards.

4.4.13.7 *Test method*

a) General

Test the Front and Rear Wheels individually.

b) Running-in the braking surfaces

Conduct a running-in process on every brake before the Performance test is performed.

In order to determine the operating force to be used during the running-in process, mount and load the bicycle on the test machine with the belt or drum running at the specified speed and apply an operating force to the brake lever or the pedal that is high enough to achieve a braking force of 200 N ± 10 percent. Maintain this operating force for atleast 2.5 s, and note the value of the applied operating force. Repeat the procedure (applying the operating force determined in the paragraph above accurate to within ± 5 percent) 10 times, or with more repetitions, if necessary, until the mean Braking force from anyone of the three latest tests does not deviate by more than ± 10 percent from the mean braking force from these same three tests.

c) The performance tests

i) Testing under dry conditions

For hand-operated brakes, with a vertical force applied to the bicycle sufficient to prevent skidding of the yre on the wheel under test, accelerate the driving mechanism to the specified velocity, then apply the operating force in a series of 20 N increments from 40 N to either 180 N (in case of young adult bicycles, apply to 120 N) or to the force necessary to achieve a braking force of atleast 700 N, whichever is the lesser. However, if the wheel locks, if any possible brake-overload device is actuated, or if the hand lever comes into contact with the handle bar, do not increase the force further. For each increment of applied operating force, perform three tests within 1 minute. Before applying the next level of operating force, allow the brake to cool for 1 minute.

For Back-Pedal brakes, with a vertical force applied to the bicycle sufficient to prevent skidding of the Tyre on the wheel under test, accelerate the driving mechanism to the specified velocity, then apply the operating force in a series of 50 N increments from 100 N to either 350 N or to the force necessary to achieve a Braking force of atleast 400 N, whichever is the lesser. However, if the wheel locks, if any possible brake-overload device is actuated, do not increase the force further. For each increment of applied operating force, perform three tests within 1 minute. Before applying the next level of operating force, allow the brake to cool for 1 minute.

The applied operating forces shall lie within ± 10 percent of the intended operating forces, shall be applied as specified in Fig. 10 and Fig. 11 and **4.4.13.4** (c), shall be recorded with an accuracy of ± 1 percent, and shall be fully applied within 1.0 s of the commencement of braking.

For each increment of operating force, record the braking force value, $F_{\mathrm{Br\ rec}}$, for a period of between 2.0 s and 2.5 s, with measurement starting 0.5 s to 1.0 s after the commencement of braking. Record $F_{\mathrm{Br\ rec}}$ as the average braking force during this measurement period.

The time at which the measurement of the braking force is started shall be related to the speed at which the operating force is applied. If the operating force is fully applied in less than 0.5 s after the commencement of braking, start the measurement after 0.5 s. However, if the operating force is fully applied between 0.5 s and 1.0 s after the commencement of braking, start the measurement when the operating force is fully applied.

ii) Testing under wet conditions

The method shall be as given in **4.4.13.7** (c) (i) with the addition that wetting of the brake system shall commence not less than 5.0 s before the commencement of braking and shall continue until the measurement period has ended. Water nozzles shall be arranged according to Fig. 21.

d) Correction of braking force

Each recorded braking force, $F_{\mathrm{Br\ rec}}$, shall be corrected for any difference between the recorded operating force and the intended operating force. The corrected braking force shall be calculated by multiplying the recorded braking force, F_{Brrec}, with a correction factor which is the ratio between the intended operating force, $F_{\mathrm{op\ intend}}$, and the recorded operating force, F_{Brrec}.

Example:

1) Recorded braking force F_{Brrec} = 225 N intended operating force $F_{\mathrm{op\ intend}}$ = 180 N

2) Recorded operating force $F_{\mathrm{op\ rec}}$ = 184 N Correction factor = 180/184

3) Corrected braking force $F_{\mathrm{Br\ corr}}$ = 225 × (180/184)

e) Test results

Select from the record the maximum output braking force, $F_{\mathrm{Br\ max}}$, for each combination of wheel (front or rear) and each test condition (wet or dry).

The braking performance value shall be calculated using Formula (3):

$$B_{\mathrm{p}} = F_{\mathrm{Br\ max}} \text{ x } (m/M) \qquad (3)$$

where

B_{p} = Braking performance value (N);

$F_{\mathrm{Br\ max}}$ = Maximum F_{Br} average (N);

m = Standard mass of the Bicycle defined as 100 kg for adult bicycle and 60 kg for young adult bicycle (kg); and

M = Maximum permissible total mass (bicycle + rider + luggage).

Where a manufacturer specifies that his bicycle can carry a mass such that the sum of that mass plus the mass of the bicycle is in excess of 100 kg (60 kg for young adults) to some value m, apply M as total weight.

f) Linearity

Plot the calculated F_{Br} average values (the arithmetic mean of the three corrected braking force sat each level of operating force) against the equivalent operating force values, F_{op} intend, in order to assess the linearity against the requirement in **4.4.3.3**, Plot the results on a graph, showing the line of best fit and the ± 20 percent limit lines obtained by the method of least squares outlined in Annex C.

g) Ratio between wet and dry braking for city and trekking/roadster/SLR, young adult, and mountain bicycles

For any operating force (F_{op}) for which the measured dry braking force (F^{D}_{Br} average) is greater than 200 N, the ratio between the measured braking force in wet conditions (F^{W}_{Br} average) and the measured braking force in dry conditions (F^{D}_{Br} average) shall be greater than 40 percent.

For each F_{op}, where F^{D}_{Br} average is > 200 N, determine whether or not the requirements of have been met using formula (4):

$$F^{W}_{Br} \text{ average}: F^{D}_{Br} \text{ average}$$

For symbols, *see* **4.4.13.2.**

h) Simple track test (*see* **6.2)**

After completion of the machine test, conduct a brief, simple track test with progressively increasing operating forces to determine whether or not the Brakes bring the bicycle to a smooth, safe stop.

NOTE — This test can be combined with the test on the fully assembled bicycle.

4.4.13.8 *Brakes – heat- resistance test*

4.4.13.8.1 *General*

This test applies to all disc and hub brakes but it applies to rim brakes only where they are known or suspected to be manufactured from or include thermoplastic materials. Each brake on the bicycle shall be tested individually, but where the front and rear brakes are identical, only one brake needs to be tested.

4.4.13.8.2 *Requirement*

Throughout the test described in **4.4.13.8.3** the brake lever shall not touch the handlebar grip, the operating force shall not exceed 180 N, and the braking force shall not deviate outside the range 60 N to 115 N. Immediately after having been subjected to the test described in **4.4.13.8.3**, the brakes shall achieve at least 60 percent of the braking performance, which was recorded at the highest operating force used during the performance tests **4.4.13.7** [(c) (i) and (ii)].

4.4.13.8.3 *Test method*

Drive the wheel and tyre assembly with the brake applied on a machine such as those described in **4.4.13.5** at a velocity of 12.5 km/h ± 5 percent with a rearward, cooling air-velocity of 12.5 km/h ± 10 percent, so that a total braking energy of E (Wh) ± 5 percent specified in Table 4 is developed. The duration of the test shall be 15 min ± 2 minute.
Allow the brake to cool to ambient temperature and then repeat the test cycle.

A maximum of 10 interruptions per test cycle is permitted, each with a maximum duration of 10 s. When the test has been carried out, subject the Brakes to the applicable parts of the tests described in **4.4.13.7**(c) (i) and (ii).

Calculate the braking energy from formula (5):

$E = F_{Br} \times V_{Br} \times T$ *(in watt hour units)*

where

F_{Br} is the braking force (N);
V_{Br} is the linear velocity of the periphery of the tyre (that is, 12.5 km/h = 3.472 m/s); and
T is the duration of each test cycle (excluding interruptions) (that is, 15 minute = 0.25 h).

Table 4 Total Braking Energy
(*Clause* 4.4.13.8.3)

Sl No.	Bicycle Type	City and Trekking/ Roadster/SLR Bicycles	Young Adult Bicycles	Mountain Bicycles	Racing Bicycles
(1)	(2)	(3)	(4)	(5)	(6)
i)	Total braking energy, E (Wh)	55	55	75	75

When the test has been carried out, the brakes shall be subjected to the applicable parts of the test described in **4.4.13**, in order to check that the requirement in **4.4.13.8.2** is fulfilled.

4.4.14 *Smooth, Safe-Stop Characteristics*

The bicycle shall show smooth, safe-stop characteristics with regard to the intended use of the bicycle and the ability of the expected user of the bicycle.

a) For the track test, smooth, safe-stop characteristics are defined as stopping within the required distances without occurrence of any of the following:

   1) Excessive juddering;
   2) Front wheel locking;
   3) Bicycle overturning (rear wheel lifting uncontrollably);
   4) Rider’s loss of control; and
   5) Excessive side-skid causing the rider to put his foot to the ground to retain control.

   With certain types of braking system, it might not be possible to avoid entirely some skidding of the rear wheel during braking; this is considered acceptable provided that (iv) or (v) above do not occur as a result. Back pedal brakes shall additionally comply with the linearity test of **4.4 8.11**.

b) For the machine test, smooth, safe-stop characteristics are defined by compliance with the linearity requirements specified in **4.4.13.3** and the simple track test described in **4.4.13.7** (h).

4.4.15 *Ratio Between Wet and Dry Braking Performance*

For city and trekking/roadster/SLR, young adult, and mountain bicycles, in order to ensure safety for both wet and dry braking, the ratio of braking performance wet/dry shall be greater than 4 : 10. The methods for calculating this ratio are given in **4.4.10.12** (c) for the track test and in **4.4.13.7** (g) for the machine test. **4.4.15** is not applicable to racing bicycles.

4.5 Steering

4.5.1 *Handlebar — Dimensions*

The handlebar shall have an overall width between 350 mm and 1 000 mm unless national regulations dictate otherwise. Adjust the handlebar height to its highest normal riding position and the saddle to its lowest normal riding position as specified by the manufacturer, *see* **6.4**. Measure the vertical distance from the center and top of the handlebar grips to a point where the saddle surface is intersected by the seat post axis (*see* Fig. 22). This dimension shall not exceed 400 mm. The ends of the handlebars shall be fitted with handgrips or end plugs that will withstand a removal force of 70 N.

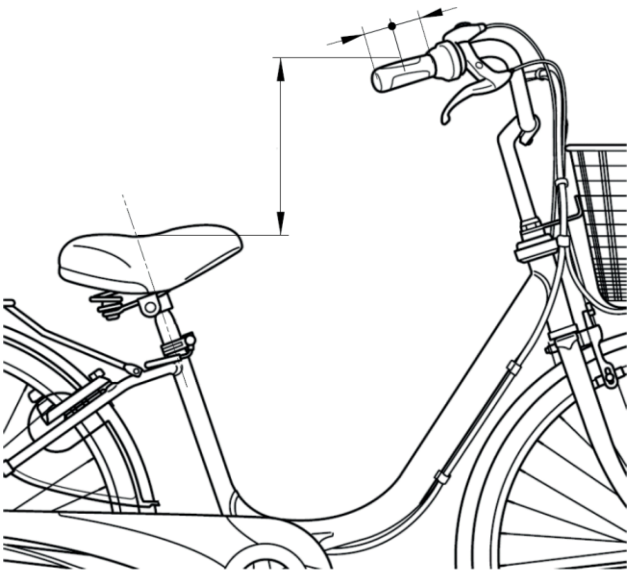


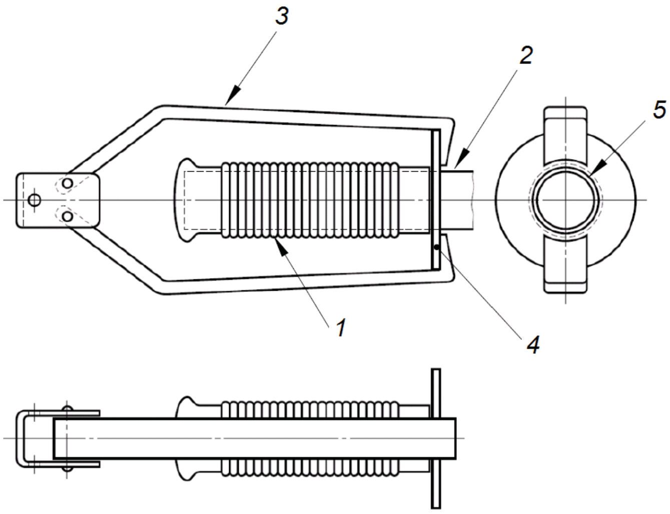
FIG. 22 THE VERTICAL DISTANCE BETWEEN THE HANDLEBAR GRIPS AND THE SEAT SURFACE

4.5.2 *Handlebar Grips and Plugs*

The ends of the handlebar shall be fitted with handgrips or end plugs. When subjected to freezing test and hot water test, the handgrips or plugs shall withstand the specified removal forces.

4.5.2.1 *Freezing test*

Immerse the handlebar, with handlebar grips or plugs fitted, in water at room temperature for 1 h and then place the handlebar in a freezer until the handlebar is at a temperature lower than − 5 °C. Remove the handlebar from the freezer and allow the temperature of the handlebar to reach − 5 °C, and then apply a force of 70 N to the grip or plug in the loosening direction as shown in Fig. 20. Maintain the force until the temperature of the handlebar has reached 5 °C. It shall be permitted to create a hole in the plug to allow for the testing fixture to be fitted so long as the hole does not affect the seat of the plug in the Handlebar and the fixture does not contact the handlebar during the test.



Key
1 Handlebar grip;
2 Handlebar;
3 Drawing attachment;
4 Hooking ring; and
5 Clearance.

NOTE — The hooking ring can be divided.

FIG. 23 EXAMPLE OF HANDLEBAR GRIP DRAWING ATTACHMENT

4.5.2.2 *Hot water test*

Immerse the handlebar, with handlebar grips fitted, in hot water of 60 ± 2 °C for 1 h. Remove the handlebar from the hot water, allow the handlebar to stabilize at ambient temperature for 30 min, and apply a force of 100 N to the grip in the loosening direction as shown in Fig. 23. Maintain this force for 1 minute.

4.5.3 *Handlebar Stem — Insertion-Depth Mark or Positive Stop*

The handlebar stem shall be provided with one of the two following alternative means of ensuring a safe insertion depth into the fork steerer.

a) It shall contain a permanent, transverse mark, of length not less than the external diameter of the stem that clearly indicates the minimum insertion depth of the handlebar stem into the fork steerer. The insertion mark shall be located at a position not less than 2.5 times the external diameter of the handlebar stem from the bottom of the stem, and there shall be atleast one stem diameter’s length of contiguous, circumferential stem material below the mark.

b) It shall incorporate a permanent stop to prevent it from being drawn out of the fork steerer such as to leave the insertion less than the amount specified in (a) above.

4.5.3.1 *Expander bolt for handlebar stem*

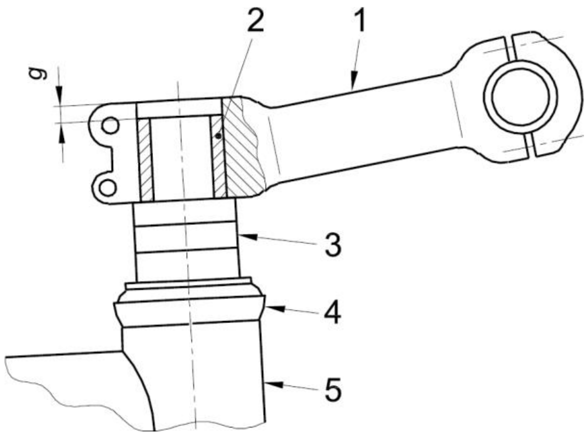
The minimum failure torque of the bolt shall be at least 50 percent greater than the manufacturer's recommended maximum tightening torque, *see* **6.4** (n).

4.5.4 *Handlebar Stem to Fork Steerer — Clamping Requirements*

The distance ‘*g’* (*see* Fig. 24) between the top of the handlebar stem and the top of the fork steerer to which the handlebar stem is clamped shall not be more than 5 mm. The upper part of the fork steerer to which the handlebar stem is clamped shall not be threaded.

The dimension ‘*g’* shall also ensure that the proper adjustment of the steering system can be achieved.

For aluminum and composite fork steerer, any internal device that could damage the internal surface of the fork steerer should be avoided.



Key

g Distance between the upper, clamping part of the Handlebar stem and the upper part of the Fork steerer;
1 Handlebar stem;
2 Extended fork steerer;
3 Spacer rings;
4 Head set; and
5 Head tube.

FIG. 24 CLAMPING BETWEEN THE HANDLEBAR STEM AND FORK STEERER

4.5.5 *Steering Stability*

The steering shall be free to turn through at least an angle of $\theta 1$ either side of the straight-ahead position and shall exhibit no tight spots, stiffness, or slackness in the bearings when correctly adjusted. The values are given in Table 5.

A minimum of 25 percent of the total mass of the bicycle and rider shall act on the front wheel when the rider is holding the handlebar grips and sitting on the saddle, with the saddle and rider in their most rearward positions. For recommended steering geometry, *see* also Annex D.

4.5.6 *Steering Assembly — Static strength and Security Tests*

4.5.6.1 *Handlebar stem — lateral bending test*

Table 5 Steering Angle
(*Clause* 4.5.5)

Sl No.	Bicycle Type	City and Trekking and Roadster/SLR Bicycles	Young Adult Bicycles	Mountain Bicycles	Racing Bicycles
(1)	(2)	(3)	(4)	(5)	(6)
i)	Steering angle, $\theta 1$ (degree)	60	60	30	30

4.5.6.1.1 *General*

This test is intended for stem manufacturers who do not produce handlebars.

4.5.6.1.2 *Requirement*

When tested by the method described in **4.5.6.1.3**, there shall be no cracking or fracture of the stem and the permanent deformation measured at the point of application of the test force and in the direction of the test force shall not exceed 10 mm. For general crack detection methods, *see* Annex E.

Handlebar stems can influence test failures of handlebars but handlebars do not usually influence test failures of stems. For these reasons, a handlebar is always to be tested mounted on a stem but stems

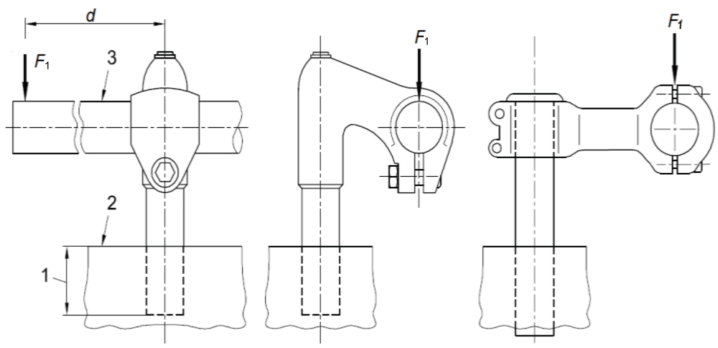
can be tested with a solid bar in place of a handlebar.

4.5.6.1.3 ***Test Method***

For stems which have a quill for insertion into a fork steerer, clamp the quill securely in a fixture to the minimum insertion depth as specified in **4.5.3**, or for stem extensions which clamp directly on to an extended fork stem, attach the extension to a fork stem according to the manufacturer's instructions and clamp this fork steerer securely in a fixture to the appropriate height. Assemble a test bar to the stem, and apply a force of $F1$ at a distance of d from the axis of the stem as shown in Table 6 and Fig. 25. Maintain this force for 1 minute.

Table 6 Forces and Distances on Handlebars
(*Clause* 4.5.6.1.3)

Sl No.	**Bicycle Type**	**City and Trekking and Roadster/SLR Bicycles**	**Young Adult Bicycles**	**Mountain Bicycles**	**Racing Bicycles**
(1)	(2)	(3)	(4)	(5)	(6)
i)	Force, F1 (N)	600	600	1 000	1 000
ii)	Distance, d (mm)	300	300	300	230



a) Combined stem and quill b) Stem extension

Key
1 Minimum insertion depth;
2 Clamping block; and
3 Solid-steel bar.

FIG. 25 HANDLEBAR STEM — LATERAL BENDING TEST

4.5.6.2 *Handlebar and stem assembly — lateral bending test*

4.5.6.2.1 *General*

This test is for manufacturers who produce handlebars and stems or for cycle manufacturers.

4.5.6.2.2 *Requirement*

When tested by the method described in **4.5.6.2.3**, there shall be no cracking or fracture of the handlebar, stem, or clamp-bolt and the permanent deformation measured at the point of application of the test force shall not exceed 15 mm. For general crack detection methods, *see* Annex E.

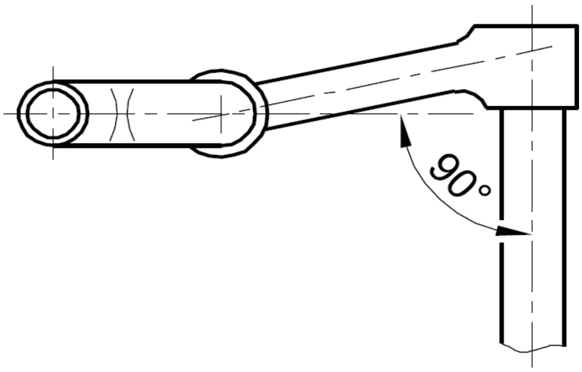
4.5.6.2.3 *Test Method*

Assemble the handlebar and stem in accordance with the manufacturer's instructions and, unless the handlebar and stem are permanently connected, for example, by welding or brazing, align the grips portion of the handlebar in a plane perpendicular to the stem axis [*see* Fig. 26 (a) or Fig. 27 (a)]. For stems which have a quill for insertion into a fork steerer, clamp the quill securely in a fixture to the minimum insertion depth, or for stem extensions which clamp directly on to an extended fork steerer, attach the extension to a fork steerer according to the manufacturer's instructions and clamp this fork steerer securely in a fixture to the appropriate height.

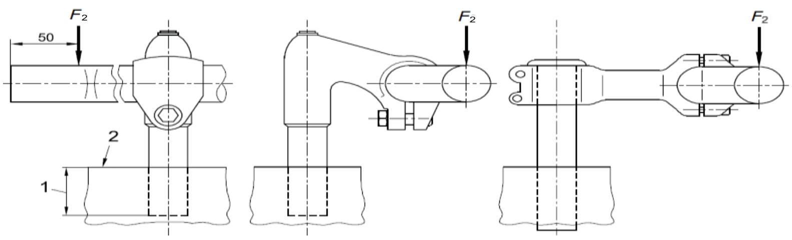
Apply a force of F2 (*see* Table 7) at a distance of 50 mm from the free end of the Handlebar and parallel to the axis of the fork steerer as shown in Fig. 26 or 27. Maintain this force for 1 minute.

Table 7 Forces on Handlebars
(*Clause* 4.5.6.2.3)

Sl No.	**Bicycle Type**	**City and trekking/Roadster/SLR Bicycles**	**Young Adult Bicycles**	**Mountain Bicycles**	**Racing Bicycles**
(1)	(2)	(3)	(4)	(5)	(6)
i)	Force, $F2$, (N)	600	600	1 000	1 000



a) Orientation of adjustable handlebars



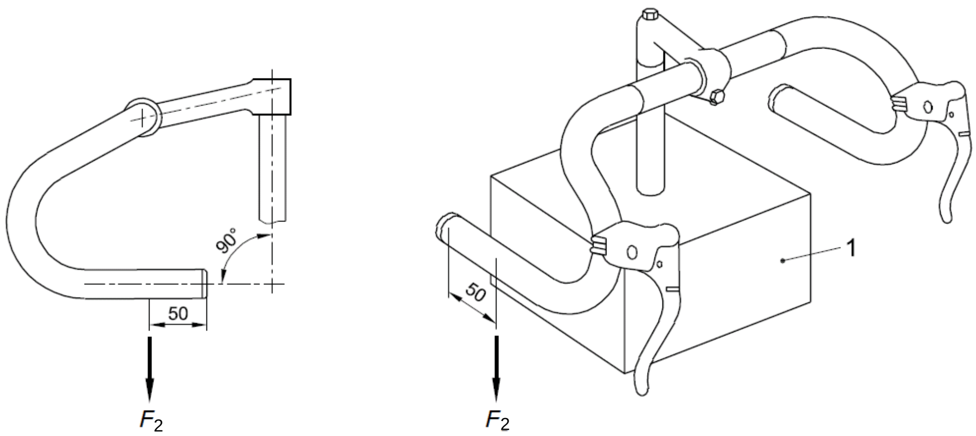
b) Combined Stem and Quill c) Stem extension

Key

1 Minimum insertion depth; and
2 Clamping block.

All dimensions are in millimeters

FIG. 26 HANDLE BAR AND STEM ASSEMBLY — LATERAL BENDING TEST FOR CITY AND TREKKING/ROADSTER/SLR YOUNG ADULT AND MOUNTAIN BICYCLES



a) Orientation of adjustable Handlebars   b) Position of Applied forces

Key

1 Clamping fixture.

FIG. 27 HANDLE BAR AND STEM ASSEMBLY — LATERAL BENDING TEST FOR CITY AND TREKKING/ ROADSTER/SLR AND RACING BICYCLES

4.5.6.3 *Handlebar-stem — forward bending test*

4.5.6.3.1 *General*

Conduct the test in two stages on the same assembly as follows.

4.5.6.3.2 *Requirement for stage 1*

When tested by the method described in **4.5.6.3.3.1**, there shall be no visible cracks or fractures and the permanent deformation measured at the point of application of the test force and in the direction of the test force shall not exceed 10 mm. For general crack detection methods, *see* Annex E.

4.5.6.3.2.1 *Test method for stage 1*

For stems which have a quill for insertion into a fork steerer, clamp the quill securely in a fixture to the minimum insertion depth, or for stem extensions which clamp directly on to an extended fork steerer, clamp the handlebar stem extension securely on to a suitable, solid-steel bar and clamp the bar in securely in a fixture, the projecting length of the bar not being critical.

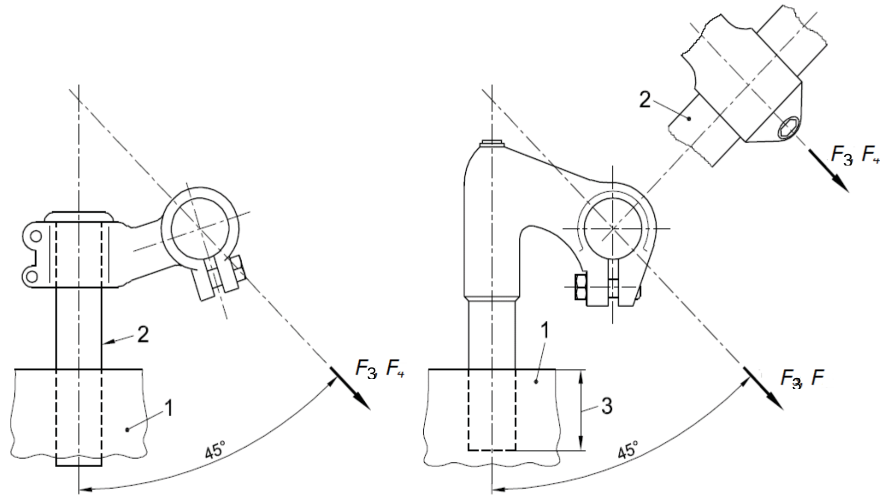
Apply a force of $F3$ through the handlebar attachment point in a forward and downward direction and at 45° to the axis of the quill or steel bar as shown in Fig. 28 and maintain this force for 1 minute or the fixture may be adjusted accordingly to get the desired angle 45° of the load application. The forces are given in Table 8. Release the test force and measure any permanent deformation.

If the handlebar stem meets the requirement of **4.5.6.3.2**, conduct stage 2 of the test.

Table 8 Forces on Stems

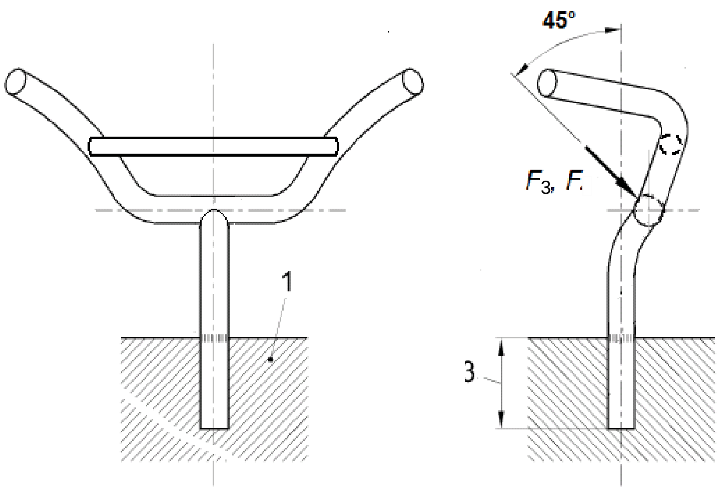
(*Clause* 4.5.6.3.2.1 *and* 4.5.6.3.3.1)

Sl No.	**Bicycle Type**	**City and Trekking/ Roadster/SLR Bicycles**	**Young Adult Bicycles**	**Mountain Bicycles**	**Racing Bicycles**
(1)	(2)	(3)	(4)	(5)	(6)
i)	Stage 1 Force, $F3$, (N)	1 600	1 600	1 600	1 600
ii)	Stage 2 Force, $F4$, (N)	2 000	2 000	2 600	2 300



a) Stem Extension

b) Combined Stem and Quill



c) One-piece Stem-Handlebar

Key

1 Clamping fixture;

2 Solid-steel bar; and

3 Minimum insertion depth.

FIG. 28 HANDLE BAR STEM — FORWARD BENDING TEST

4.5.6.3.3 *Requirement for stage 2*

When tested by the method described in **4.5.6.3.3.1** there shall be no visible cracks or fractures. For general crack detection methods, *see* Annex E.

4.5.6.3.3.1 *Test method for stage 2*

With the handlebar stem mounted as in stage 1 (*see* **4.5.6.3.2.1**), apply a progressively increasing force in the same position and direction as in **4.5.6.3.2.1** until either the force reaches a maximum of $F4$ or until the Handlebar stem deflects 50 mm measured at the point of application of the test force and in the direction of the test force. If the stem does not yield or continue to yield, maintain the force for 1 minute. The forces are given in Table 8.

4.5.6.4 *Handlebar to handlebar stem — torsional security test*

When tested by the method described in **4.5.6.4.1**,

there shall be no movement of the handlebar relative to the handlebar stem.

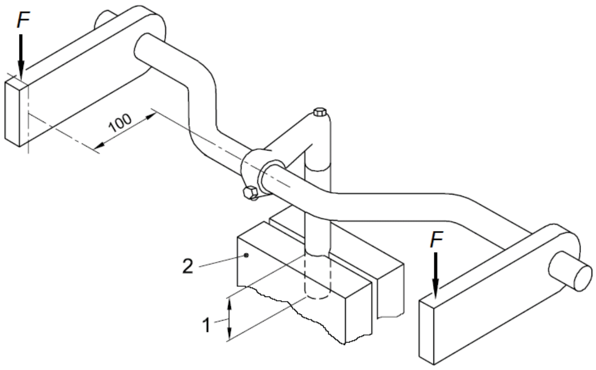
4.5.6.4.1 *Test method*

Assemble the handlebar correctly in the handlebar stem with the locking system tightened in accordance with the manufacturer's instructions and clamp the handlebar stem securely in a fixture to the minimum insertion depth and with its axis vertical. Apply a torque of T_1 about the centerline of the stem-clamp. Divide the torque equally, by vertically, downward forces applied to both sides of the Handlebar and maintain the forces for 1 minute. The torque is given in Table 9.

NOTE — The exact method of applying the torque will vary with the type of handlebar, and an example is shown in Fig. 29 ($T_1 = F \times L$)

Table 9 Torque on Handlebar
(*Clause* 4.5.6.4.1)

Sl No.	**Bicycle Type**	**City and Trekking/ Roadster/SLR Bicycles**	**Young Adult Bicycles**	**Mountain Bicycles**	**Racing Bicycles**
(1)	(2)	(3)	(4)	(5)	(6)
i)	Torque, T_1 (Nm)	60	60	80	60



Key
1 Minimum insertion depth; and
2 Clamping block.

FIG.29 HANDLEBAR TO HANDLEBAR STEM

4.5.6.5 *Handlebar stem to fork steerer — Torsional security test*

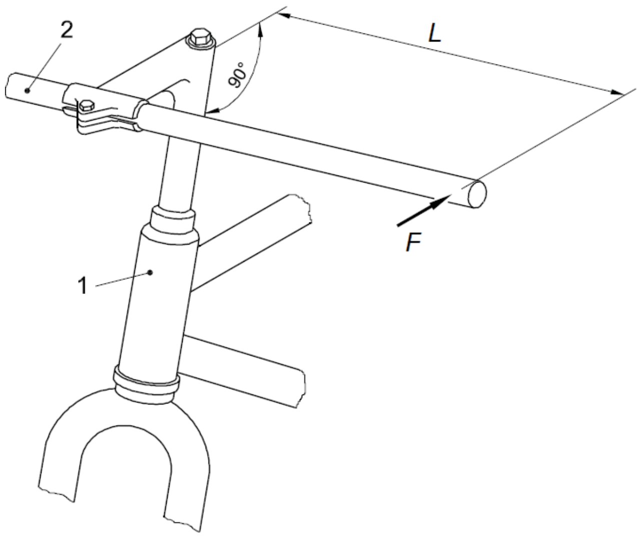
When tested by the method described in **4.5.6.5.1**, there shall be no movement of the handlebar stem relative to the fork steerer.

4.5.6.5.1 *Test Method*

Assemble the fork steerer correctly in the frame and attach the handlebar stem to the fork steerer with the locking system tightened in accordance with the manufacturer 's instructions, and apply a torque of T_2 once in each direction of possible rotation by applying a force on the test bar in a plane perpendicular to the axis of the fork steerer/ handlebar stem. Maintain each torque for 1 minute. The torque is given in Table 10. The exact method of applying the torque can vary, and an example is shown in Fig. 30.

Table 10 Torque on Handlebar Stem
(*Clause* 4.5.6.5.1)

Sl No.	Bicycle Type	City and Trekking/ Roadster /SLR Bicycles	Young Adult Bicycles	Mountain Bicycles	Racing Bicycles
(1)	(2)	(3)	(4)	(5)	(6)
i)	Torque, T_2, (Nm)	40	40	50	40



Key
1 Frame and Fork assembly; and
2 Solid-steel bar.

FIG.30 HANDLEBAR STEM TO FORK STEERER — TORSIONAL SECURITY TEST

4.5.6.6 *Bar end to handlebar — Torsional security test*

When tested by the method described in **4.5.6.6.1,** there shall be no movement of the bar ends in relation to the handlebar.

4.5.6.6.1 *Test Method*

Secure the handlebar in a suitable fixture and assemble the bar end on the handlebar tightening the fixings in accordance with the bar end manufacturer's instructions. Apply a force of F_5 (*see* Table 11) to the following position:

a) If the bar end's length is more than 100 mm, at a distance of 50 mm from the free end of the bar end [*see* Fig. 31 (a)];

b) If the bar end's length is from 50 mm to 100 mm, at a distance of 50 mm from the axis of the handlebar [*see* Fig. 31 (b)]; and

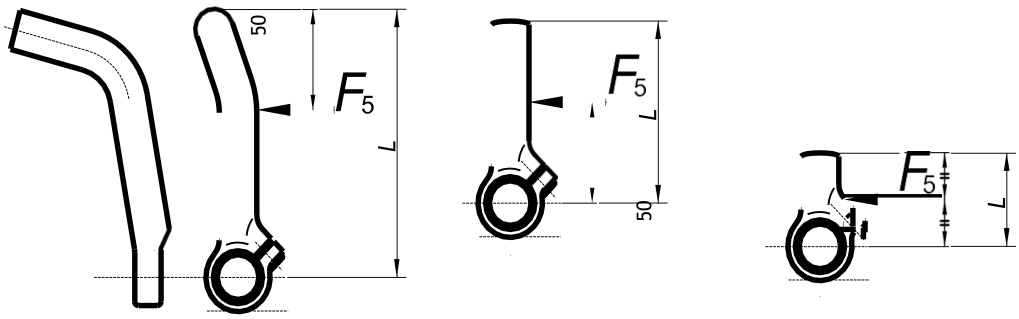
c) If the bar length end's length is less than 50 mm, apply a load to the mid-point of the bar end [*see* Fig. 31 c)]. Maintain this force for 1 minute.

Table 11 Forces on Bar End

(*Clause* 4.5.6.6.1)

Sl No.	Bicycle Type	City and trekking/Roadster/SLR Bicycles	Young Adult Bicycles	Mountain Bicycles	Racing Bicycles
(1)	(2)	(3)	(4)	(5)	(6)
i)	Force, F_5 (N)	300	300	500	300

All dimensions are in millimeters



a) L > 100 b) 100≥ L ≥ 50 c) 50 > L

Key

L Bar end's length

FIG.31 BAR END TO HANDLEBAR — TORSIONAL SECURITY TEST

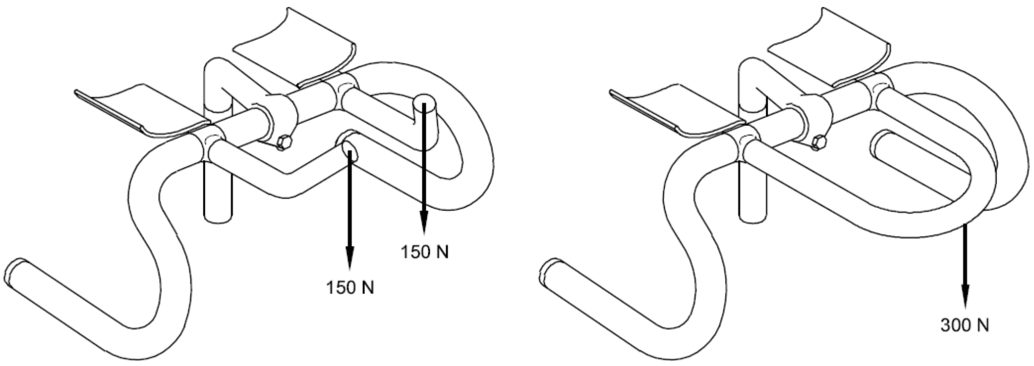
4.5.6.7 *Aerodynamic extensions to Handlebar — Torsional Security Test*

When a handlebar is suitable for use with aerodynamic extensions, the extension/handlebar/ handlebar stem assembly shall with stand the following security test.

When tested by the method described in **4.5.6.7.1**, there shall be no movement of the extension in relation to the handlebar and of the handlebar in relation to the handlebar stem.

4.5.6.7.1 *Test method*

Secure the handlebar in the stem intended for use and assemble the extension on the handlebar tightening all the fixings in accordance with the extension, handlebar, and handlebar stem manufacturer's instructions. The steering axis should be vertical. Apply a vertical force of 300 N to the extension on the position giving the maximum torque to the clamps as shown in Fig. 32 (a) and (b). The exact method of applying the force can vary with the type of aerodynamic extension, and an example is shown in Fig. 32.



a) Type A b) Type B

FIG. 32 AERODYNAMIC EXTENSION TO HANDLEBAR — TORSIONAL SECURITY TEST

4.5.7 *Handlebar and Stem Assembly — Fatigue Test*

4.5.7.1 *General*

Handlebar stems can influence test failures of handlebars and, for this reason, a handlebar shall always be tested mounted on a stem, but it is permitted to test a stem with a solid bar in place of the handlebar and bar ends with dimensions corresponding to handlebars/bar ends suitable for that stem.

When the fatigue test is for the stem only, the manufacturer of the stem shall specify the types and sizes of handlebar for which the stem is intended and the test shall be based on the most severe combination. Conduct the test in two stages on the same assembly.

4.5.7.2 *Requirement for stage 1 and stage 2*

When tested by the method described in **4.5.7.2.1** or **4.5.7.2.2**, there shall be no visible cracks or fractures in any part of the handlebar and stem assembly or any bolt failure. For general crack detection methods, *see* Annex E.

For composite handlebars or stems, the running displacements (peak-to-peak value) at the points where the test forces are applied shall not increase by more than 20 percent of the initial values.

4.5.7.2.1 *Test method for stage 1*

Unless the handlebar and stem are permanently connected, for example, by welding or brazing, align the grips of portion of the handlebar in a plane perpendicular to the stem axis [*see* Fig. 33 (a)] and secure the handlebar to the stem according to the manufacturer's instructions.

Clamp the handlebar stem securely in a fixture to the minimum insertion depth as specified in **4.5.7.3** or in the case of a stem extension which is intended to be clamped to an extended fork steerer, secure the extension using the manufacturer's recommended tightening procedure to an extended fork steerer which is secured in fixture to the appropriate length.

a) For handlebars where the manufacturer states that they are not intended for use with bar ends, Apply fully reversed forces of $F6$ at a position 50 mm from the free end for each side of the handlebar for 100 000 cycles, with the forces at each end of the handlebar being out of phase with each other and parallel to the axis of the fork steerer as shown in Fig. 33 (a).

b) The forces are given in Table 12. The maximum test frequency shall be maintained as specified in **4.5.7.2**.

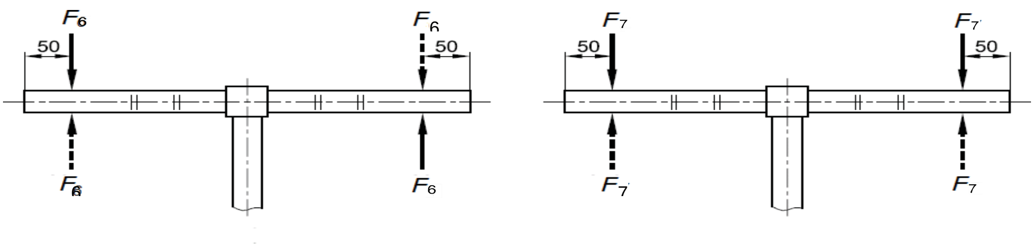
c) Where a bicycle manufacturer fits bar ends, fit the bar ends to the handlebar according to the manufacturer's tightening instructions but with the bar ends located in a plane perpendicular to the handlebar stem axis and apply the out-of-phase forces to the bar ends, as shown in Fig. 31 and Fig. 34 (a).

d) Where a handlebar manufacturer specifies that his handlebars are suitable for use with bar ends, conduct the test with the out-of-phase forces applied to simulated bar ends, as shown in Fig. 34 (b).

If the handlebar meets the requirement as specified in **4.5.7.2**, remove any bar ends and conduct stage 2 of the test with the assembly in the same mountings.

Table 12 Forces on Handlebars and Bar Ends
(*Clause* 4.5.7.2.1, 4.5.7.3.1 *and* 4.5.7.3.2)

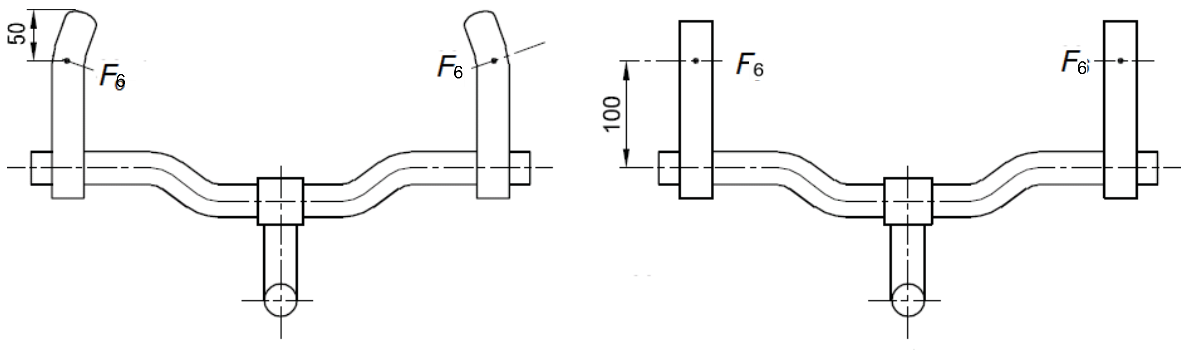
Sl No.	Bicycle Type	City and Trekking/ Roadster/ SLR Bicycles	Young Adult Bicycles	Mountain Bicycles	Racing Bicycles
(1)	(2)	(3)	(4)	(5)	(6)
i)	Stage 1 Force, *F*6, (N)	200	200	270	280
ii)	Stage 2 Force, F7, (N)	250	250	450	400



a) Stage 1 — Out-of-phase loading   b) Stage 2 — In-phase loading

All dimensions are in millimeters

FIG. 33 HANDLEBAR AND STEM — FATIGUE TESTS FOR CITY AND TREKKING /ROADSTER/SLR YOUNG ADULT, AND MOUNTAIN BICYCLES



a) Test for Handlebar fitted with bar ends (Plan view)   b) Test for Handlebar intended for bar ends (Plan view)

FIG. 34 HANDLE BAR INCORPORATING BAR ENDS — OUT OF PHASE FATIGUE TESTS FOR CITY AND TREKKING/ROADSTER/SLR YOUNG ADULT, AND MOUNTAIN BICYCLE

4.5.7.2.2 *Test method for stage 2*

Apply fully reversed forces of *F*7 at a position 50 mm from the free end for each side of the handlebar for 100 000 cycles, with the forces at each end of the handlebar being in phase with each other parallel to the axis of the handlebar stem, as shown in Fig. 33 (b).The maximum test frequency shall be maintained as specified in **5.3**.

4.5.7.3 *Test method for Racing Bicycles*

4.5.7.3.1 *Test method for stage 1*

Unless the handlebar and stem are permanently connected, e.g., by welding or brazing, align the hand grips or the equivalent parts of the handlebar in a plane perpendicular to the steering axis (*see* Fig. 35), and secure the handlebar to the stem according to the manufacturer's instructions.

Clamp the handlebar stem securely in a fixture to the minimum insertion depth as specified in **4.5.3**, or in the case of a stem extension which is intended to be clamped to an extended fork steerer, secure the stem-extension using the manufacturer's recommended tightening procedure, to an extended fork steerer which is secured in the fixture with the appropriate length projecting.

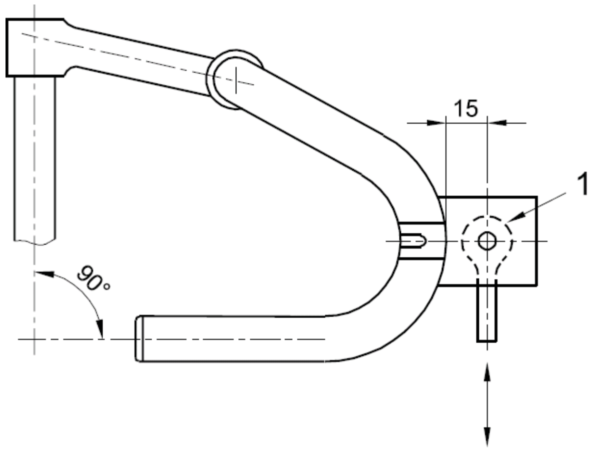
Attach to the handlebar two suitable devices that reproduce the brake-lever fixtures without either reducing or increasing the local handlebar strength. Each device shall incorporate a pin for connection to a ball joint with its axes located 15 mm from the outer surface of the handlebar, or such greater distance which accurately reproduces the position of the appropriate brake lever pivot (*see* Fig. 35).

Through the ball joints, apply reversed forces of $F6$ to the pin of the device on each side of the handlebar for 100 000 cycles, with the forces at each hide of the handlebar being out of phase with each other and parallel to the axis of the fork steerer as shown in Fig. 36 (a). The forces are given in Table 12. The maximum test frequency shall be maintained as specified in **5.3**.

If the assembly meets the requirement as specified in **4.5.7.2** conduct stage 2 of the test on the same assembly, in the same mountings.

4.5.7.3.2 *Test method for stage 2*

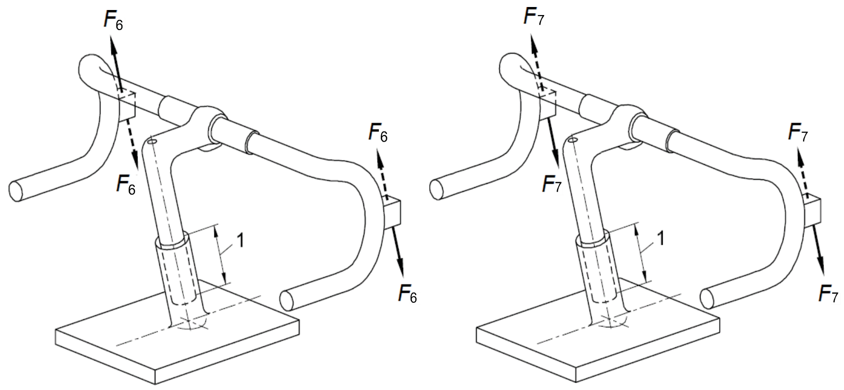
Through the ball joints, apply reversed forces of $F7$ to the pin of the device on each side of the handlebar for 100 000 cycles, with the forces at each side of the handlebar being in phase with each other and parallel to the axis of the handlebar stem of the fork steerer, as shown in Fig. 36 (b). The forces are given in Table 12. The maximum test frequency shall be maintained as specified in **5.3**.



Key
1 Ball joint.

All dimensions are in millimeters

FIG. 35 DEVICE REPRODUCING THE BRAKE FIXTURE FOR RACING BICYCLES



a) Stage 1 — Out-of-Phase Loading b) Stage 2 — In-Phase Loading

Key
1 Minimum insertion depth

FIG. 36 HANDLEBAR AND STEM ASSEMBLY — FATIGUE TEST FOR RACING BICYCLES

4.6 Frames

4.6.1 *Suspension-Frames — Special Requirements*

The design shall be such that if the spring or damper fails, the Tyre shall not contact any part of the frame or the assembly carrying the rear wheel shall become detached from the rest of the rame *see* also Annex F.

4.6.2 *Frame – Impact Test (Falling Mass)*

When tested by the method described in **4.6.2.2** there shall be no visible cracks or fractures of the frame. For general crack detection methods, *see* Annex E.

The permanent deformation measured between the axis of the wheel axles shall not exceed the following values:

a) 30 mm where a Fork is fitted; and
b) Where a dummy fork is fitted in place of a fork, the values are given in Table 13. For dummy fork characteristics, *see* also Annex G.

Table 13 Values of Permanent Deformation (Falling Mass)
(*Clause* 4.6.2)

Sl No.	Bicycle Type	City and Trekking/ Roadster/SLR Bicycles	Young Adult Bicycles	Mountain Bicycles	Racing Bicycles
(1)	(2)	(3)	(4)	(5)	(6)
i)	Permanent deformation, (mm)	10	10	10	15

4.6.2.1 *General*

Manufacturers of frames are permitted to conduct the test with a dummy fork (*see* also Annex G) fitted in place of a front fork.

Where a frame is convertible for male and female riders by the removal of a bar, test it with the bar removed. Where a suspension fork is fitted, test the assembly with the fork extended to its unloaded free length. Where a rear suspension system is incorporated in the frame, secure the suspension in a position equivalent to that which would occur with an 80 kg rider seated on the bicycle. For young adult bicycles, secure the suspension in a position equivalent to that which would occur with a 40 kg rider seated on the bicycle; if the type of suspension system does not permit it to be locked, then replace the spring/damper unit by a solid link of the appropriate size and with end fittings similar to those of the spring/damper unit.

4.6.2.2 *Test method*

Assemble a roller of mass less than or equal to 1 kg and with dimensions conforming to those shown in

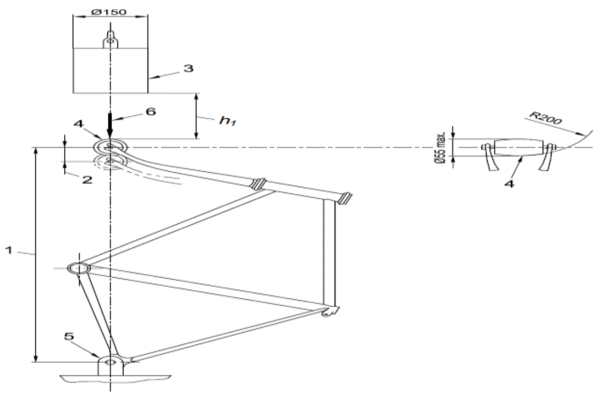
Fig. 37 in the fork. The hardness of roller shall be not less than 60 HRC at impact surface. If a dummy fork is used in place of a fork; the bar shall have a rounded end equivalent in shape to the roller. Hold the frame-fork or frame-bar assembly vertically with clamping to a rigid fixture by the rear-axle attachment points as shown in Fig. 37.

Rest a striker of mass 22.5 kg on the roller in the Fork dropouts or on the rounded end of the dummy Fork and measure the wheelbase. Raise the striker to a height of h_1 above the low-mass roller and release it to strike the roller or the steel bar at a point in line with the wheel centers and against the direction of the fork rake or rake of the bar. The drop heights are given in Table 14. The striker will bounce and this is normal. When the striker has come to rest on the roller or dummy Fork, measure the wheelbase again.

If the fork fails, the frame shall be tested with a dummy fork, *see* also Annex H.

Table 14 Drop Heights
(*Clause* 4.6.2.2)

Sl No.	Bicycle Type	City and Trekking / Roadster/SLR Bicycles	Young Adult Bicycles	Mountain Bicycles	Racing Bicycles
(1)	(2)	(3)	(4)	(5)	(6)
i)	Drop height, h_1, (mm)	180	180	360	212



Key

h_1 Drop height
1 Wheelbase;
2 Permanent deformation;
3 22.5 kg striker;
4 Low-mass roller (1 kg max.);
5 Rigid mounting for rear-axle attachment point; and
6 Direction of rearward impact.

All dimensions are in millimeters

FIG. 37 FRAME AND FRONT FORK ASSEMBLY — IMPACT TEST (FALLING MASS)

Table 15 Values of Permanent Deformation (Falling Frame)
(*Clause* 4.6.3)

Sl No.	Bicycle Type	City and Trekking/ Roadster/SLR Bicycles	Young Adult Bicycles	Mountain Bicycles	Racing Bicycles
(1)	(2)	(3)	(4)	(5)	(6)
i)	Permanent deformation (mm)	60	60	60	15

4.6.3 *Frame and Front Fork Assembly — Impact Test (Falling Frame)*

When tested by the method described in **4.6.3.2**, there shall be no visible cracks or fractures in the assembly and after the second impact there shall be no separation of any parts of any suspension system. The permanent deformation measured between the axis of the wheel axles shall not exceed the values specified in Table 15. For general crack detection methods, *see* Annex E.

4.6.3.1 *General*

Manufacturers of complete bicycles shall conduct the test with the frame fitted with the appropriate front fork. For manufacturers of frames, where the fork intended for the frame is not available, the test can be conducted with the frame fitted with a fork which meets the requirements of the fork impact test as described in **4.7.5**. Where a frame is convertible for male and female riders by the removal of a bar, test it with the bar removed. Where a suspension fork is fitted, it shall be a tits unloaded length prior to the impact. If the spring/damper unit can be locked, it shall be locked in its unloaded length position. If the spring/damper cannot be locked, use one of the two following alternative procedures:

a) Secure the fork at its extended length by an external locking method; and

b) Replace the fork by a rigid fork which is known to meet the requirements of the impact test described in **4.7.5** and of a length which is consistent with an 80 kg (in case of young adult bicycles, apply a 40 kg) rider seated in a normal riding position on the bicycle when it is equipped with the suspension fork.

Where a rear suspension system is incorporated in the frame, secure the spring/damper unit in a position equivalent to that which would occur with an 80 kg (in case of young adult bicycles, apply 40 kg) rider seated on the bicycle; if the type of suspension system does not permit it to be locked, then replace the spring/damper unit by a solid link of the appropriate size and with end fittings similar to those of the spring/damper unit.

4.6.3.2 *Test method*

Conduct the test on the assembly used for the test in **4.6.2**, or, in the case of a frame manufacturer who does not make forks, with the same frame with a suitable fork fitted (*see* **4.6.3.1**).

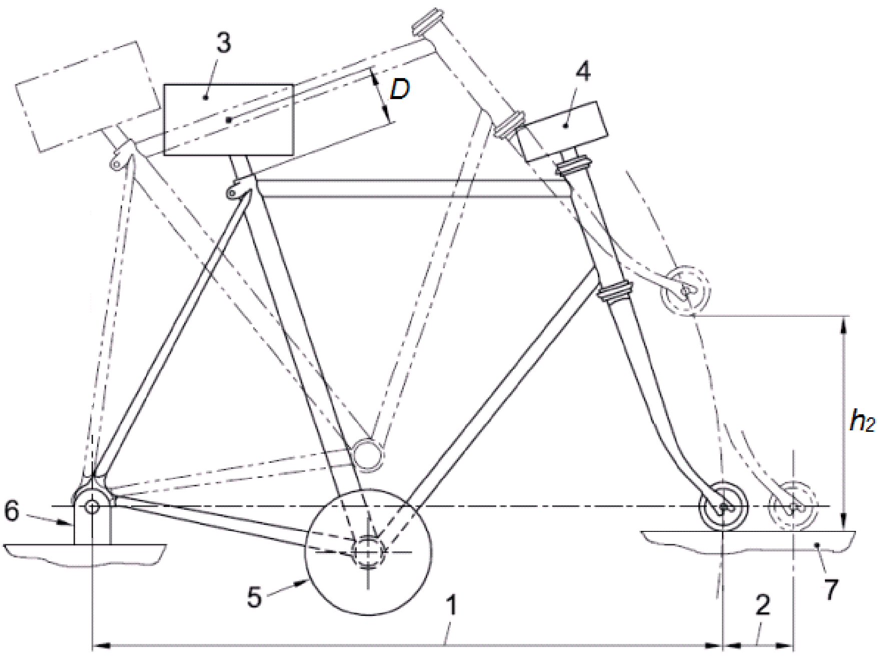
As shown in Fig. 38, mount the frame-fork assembly at its rear axle attachment points so that it is free to rotate about the rear axle in a vertical plane. Support the front fork on a flat steel anvil so that the frame is in its normal position of use. Securely fix mass $M1$ to the seat-post as shown in Fig. 38 with the center of gravity at distance (D = 75 mm) along the seat-post axis from the insertion point, and fix masses of $M2$ and $M3$ (*see* Table 16) to the top of the steering head and the bottom bracket, respectively, as shown in Fig. 38.

Measure the wheelbase with the three masses in place. Rotate the assembly about the rear axle until the distance between the low-mass roller and the anvil is $h2$, and then allow the assembly to fall freely to impact on the anvil.

Repeat the test and then measure the wheelbase again with the three masses in place and the roller resting on the anvil.

Table 16 Drop Heights and Distribution of Masses at Seat Post, Steering Head, and Bottom Bracket
(*Clause* 4.6.3.2)

Sl No.	Bicycle Type	City and Trekking/ Roadster/SLR Bicycles	Young Adult Bicycles	Mountain Bicycles	Racing Bicycles
(1)	(2)	(3)	(4)	(5)	(6)
i)	Mass 1 seat-post, *M*1 (Kg)	50	40	30	30
ii)	Mass 2 steering head, *M*2 (Kg)	10	10	10	10
iii)	Mass 3 bottom bracket, *M*3 (Kg)	30	20	50	50
iv)	Drop height, *h*2, (mm)	200	200	300	200



Key
1 Wheelbase;
2 Permanent deformation;
3 Mass 1 (*M*1);
4 Mass 2 (*M*2);
5 Mass 3 (*M3*)
6 Rigid mounting for rear-axle attachment point;
7 Steel anvil;
D Distance to the center of gravity (75 mm); and
*h*2 Drop height.

FIG. 38 FRAME AND FRONT FORK ASSEMBLY — IMPACT TEST (FALLING FRAME)

4.6.4 *Frame –Fatigue Test with Pedaling Forces*

When tested by the method described in **4.6.4.2**, there shall be no visible cracks or fractures in any part of the Frame, and there shall be no separation of any parts of the suspension system. For composite frames, the running displacements (peak-to-peak values) at the points where the test forces are applied shall not increase by more than 20 percent of the initial values of displacement (peak to peak value) taken after 1 000 cycles and before 2 000 cycles.For general crack detection methods, *see* Annex E.

4.6.4.1 *General*

All types of frames shall be subjected to this test.

In tests on suspension frames with pivoted joints, adjust the spring, air pressure, or damper to provide maximum resistance, or, for a pneumatic damper in which the air pressure cannot be adjusted, replace the suspension unit with a rigid link, ensuring that it send fixings and lateral rigidity accurately simulate those of the original unit. For suspension, frames in which the chain stays do not have pivots but rely on flexing, ensure that any dampers are set to provide the minimum resistance in order to ensure adequate testing of the frame.

4.6.4.2 *Test method*

Use a new frame/fork assembly fitted with standard head tube bearings for the test. A dummy fork (*see* also Annex G) of the same length and at least the same stiffness as the original fork can replace the front fork.

If a genuine fork is used, failures of the fork is possible; therefore, a dummy fork stiffer and stronger than the genuine fork should be used.

Where a frame is convertible for male and female riders by the removal of a bar, test it with the bar removed.

Mount the frame assembly on a base as shown in Fig. 36 with the fork or dummy fork secured by its axle to a rigid mount of height R_W (the radius of the wheel/tyre assembly ± 30 mm) and with the hub free to swivel on the axle. Secure the rear drop outs by means of the axle to a stiff, vertical link of the same height as that of the front, rigid mount, the upper connection of the link being free to swivel about the axis of the axle but providing rigidity in a lateral plane, and the lower end of the link being fitted with a ball-joint.

Fit a crank, chain wheel and chain assembly or, preferably, a strong, stiff, replacement assembly to the bottom bracket as shown in Fig. 39 and described in (a) or (b) below:

a) If a crank/chain-wheel assembly is used, incline both cranks forwards and downwards at an angle of 45° ± 2.0° to the horizontal and secure the front end of the chain to the middle chain wheel of three, the smaller chain wheel of two, or the only chain wheel. Attach the rear end of the chain to the rear axle and perpendicular to the axis of the axle; and

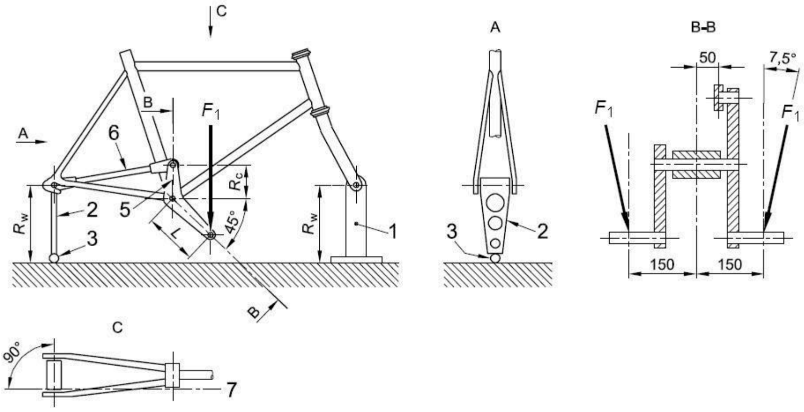
b) If an adaptor assembly is used (as shown in Fig. 39), ensure that the assembly is free to swivel about the axis of the bottom-bracket and that both replacement arms are 175 mm long (L) and that they are both inclined forwards and downwards at an angle of 45° ± 2.0° to the horizontal. Secure the position of the crank replacement arms by a vertical arm (which replaces the chain wheel) and a tie rod which has ball joints at both ends and which is attached to the rear axle perpendicular to the axis of the rear axle. The length of the vertical arm (R_C) shall be 75 mm and the axis of the tie rod shall be parallel to and 50 mm from the vertical plane through the centerline of the Frame.

Subject each pedal spindle (or equivalent adaptor component) to a repeated downward force of F_1 at a position 150 mm from the centerline of the frame in a vertical, transverse plane and inclined at 7.5° ± 2.0° to the fore/aft plane of the frame as shown in Table 17 and Fig. 39. During application of these test forces, ensure that the force on a Pedal spindle falls to 5 percent or less of the peak force before commencing application of the test force to the other pedal spindle.

Apply the test forces for 100 000 test cycles, where one test cycle consists of the application and removal of the two test forces. The maximum test frequency shall be maintained as specified in **5.3.**

Table 17 Forces on Pedal Spindle
(*Clause* 4.6.4.2)

Sl No.	Bicycle Type	City and Trekking/ Roadster/SLR Bicycles	Young Adult Bicycles	Mountain Bicycles	Racing Bicycles
(1)	(2)	(3)	(4)	(5)	(6)
i)	Force, F_1, (N)	1 000	1 000	1 200	1 100



All dimensions are in millimeters

Key

R_W Height of rigid mount and vertical link;

R_C Length of vertical arm (75 mm);

L Length of crank replacement (175 mm);

1 Rigid mount;

2 Vertical link;

3 Ball joint;

4 Adaptor assembly;

5 Vertical arm;

6 Tie rod; and

7 Centerline of tie rod.

FIG. 39 FRAME — FATIGUE TEST WITH PEDALING FORCES

4.6.5 *Frame Fatigue Test with Horizontal Forces*

4.6.5.1 *General*

Where a Frame is convertible for male and female riders by the removal of a bar, remove the bar.

It is not necessary for a genuine fork to be fitted, provided that any substitute fork is of the same length as the intended fork (*see* Annex G) and it is correctly installed in the steering-head bearings. For a suspension fork, lock it at a length equivalent to that with an 80 kg rider seated on the bicycle either by adjusting the spring/damper or by external means.

In tests on suspension frames with pivoted joints, lock the moving part of the frame into a position as would occur with an 80 kg rider seated on the bicycle. This can be achieved by locking the suspension unit in an appropriate position or, if the type of suspension system does not permit it to be locked, then the suspension system can be replaced by a solid link of the appropriate compressed size. Ensure that the axes of the front and rear axles are horizontally in line, as shown in Fig. 40. For suspension frames in which the chain stays do not have pivots but rely on flexing, ensure that any dampers are set to provide the minimum resistance in order to ensure adequate testing of the frame.

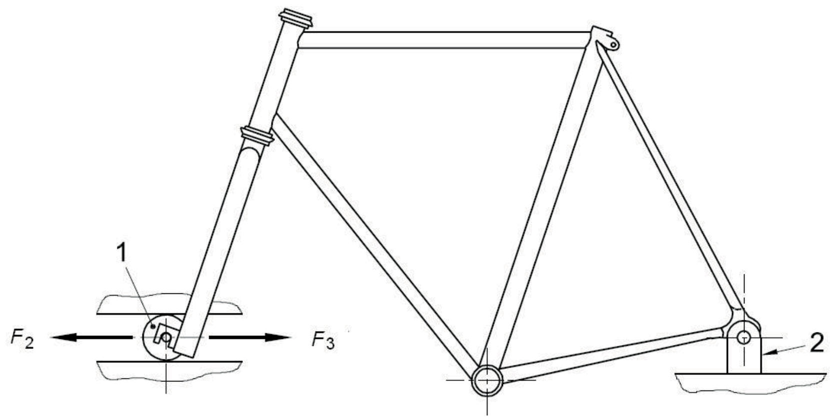
4.6.5.2 *Test method*

Mount the frame in its normal attitude and secured at the rear drop outs so that it is not restrained in a rotary sense (that is, preferably by the rear axle) as shown in Fig. 40. Ensure that the axes of the front and rear axles are horizontally inline.

Apply cycles of dynamic, horizontal forces of F_2 in a forward direction and F_3 in a rearward direction to the front fork dropouts for C_1 cycles as shown in Table 18 and Fig. 40, with the front fork constrained in vertical direction but free to move in a fore/aft direction under the applied forces. The maximum test frequency shall be maintained as specified in **5.3**.

Table 18 Forces and Cycles on Front Fork Dropouts
(*Clause* 4.6.5.2)

Sl No.	Bicycle Type	City and Trekking/ Roadster/SLR Bicycles	Young Adult Bicycles	Mountain Bicycles	Racing Bicycles
(1)	(2)	(3)	(4)	(5)	(6)
i)	Forward force, F2, (N)	450	450	450	450
ii)	Rearward force, F3, (N)	450	450	600	600
iii)	Test cycles, C1, (Number)	100 000	100 000	50 000	100 000



Key
1 Free-running guided roller; and
2 Rigid, pivoted mounting for rear-axle attachment point

FIG. 40 FRAME — FATIGUE TEST WITH HORIZONTAL FORCES

4.6.6 *Frame Fatigue Test with Vertical Forces*

4.6.6.1 *General*

Where a frame is convertible for male and female riders by the removal of a bar, remove the bar.

Where a suspension frame has adjustable brackets or linkages to vary the resistance of the bicycle against the ground-contact forces or to vary the attitude of the bicycle, arrange the positions of these adjustable components to ensure maximum forces in the frame. Secure the rear suspension as described in **4.6.4.1**.

If a suspension fork is fitted lock it at a length equivalent to that with an 80 kg (in case of young adult bicycles, apply 40 kg) rider seated on the bicycle either by adjusting the spring/damper or by external means.

4.6.6.2 *Test method*

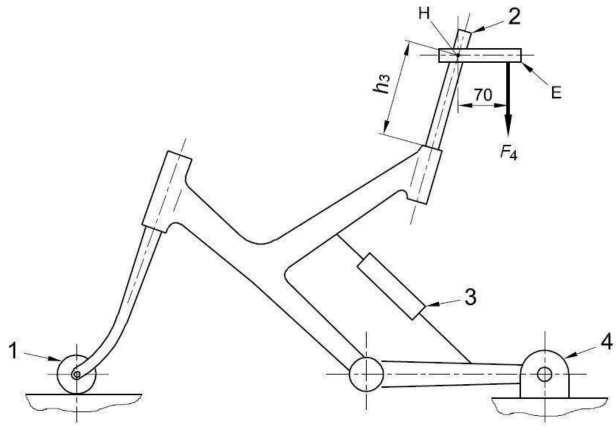
Mount the frame in its normal attitude and secured at the rear drop outs so that is not restrained in a rotary sense (that is., preferably by the rear axle) as shown in Fig. 41. Fit a suitable roller to the front axle in order to permit the frame to flex in a fore/aft sense under the test forces.

Insert intended seat post at minimum insertion depth or equivalent to a seat stem to a depth of 75 mm in the top of the seat tube and secure this to the manufacturer's instructions by the normal clamp. Securely attach a horizontal, rearward extension (E in Fig. 41) to the top of this bar such that its length (dimension $h3$ in Fig. 41) places point H in a position equivalent to that of the center of the saddle clamp with the bicycle at its maximum saddle height recommended for the particular frame, or, if the maximum saddle height information is not available dimension, $h3$ shall be 250 mm.

Apply cycles of dynamic, vertically-downward forces of $F4$ at a point 70 mm behind the intersection of the axes of the solid steel bar and the extension piece, E, as shown in Fig. 41 for 50 000 test cycles. The forces are given in Table 19. The maximum test frequency shall be maintained as specified in **5.3**.

Table 19 Forces on Seat Stem
(*Clause* 4.6.6.2)

Sl No.	**Bicycle Type**	**City and Trekking/ Roadster/SLR Bicycles**	**Young Adult Bicycles**	**Mountain Bicycles**	**Racing Bicycles**
(1)	(2)	(3)	(4)	(5)	(6)
i)	Force, F4, (N)	1 000	500	1 200	1 200



All dimensions are in millimeters

Key
E Horizontal, rearward extension;
H Position equivalent to that of the center of the saddle clamp with the bicycle;
1 Free-running roller;
2 Steel bar;
3 Locked suspension unit or solid link for pivoted chain stays; and
4 Rigid, pivoted mounting for rear axle attachment point.

FIG. 41 FRAME — FATIGUE TEST WITH VERTICAL FORCES

4.6.7 *Frame and Fork Assembly — Vibration Test*

4.6.7.1 *General*

4.6.7.1.1 When tested by the method described in Annex J, there shall be no visible fractures, deformation and distortion in any of the part of frame-fork assembly.

4.7 Front Fork

4.7.1 *General*

4.7.2, 4.7.4, 4.7.5 and **4.7.6** apply to all types of Forks. In the strength tests in **4.7.4, 4.7.5, 4.7.6** and **4.7.7**, a Suspension Fork shall be tested in its free, uncompressed length condition.

4.7.2 *Means of Location of the Axle and Wheel Retention*

The slots or other means of location for the wheel axle within the front fork shall be such that when the axle or cones are firmly abutting the top face of the slots, the front wheel remains central within the fork. The front fork and wheel shall also fulfill the requirements of **4.8.4** and **4.8.4.5**.

4.7.3 *Suspension Forks — Special Requirements*

4.7.3.1 *Tyre clearance test*

When tested by the method described in **4.7.3.2**, the tyre shall not contact the crown of the fork, nor shall the components separate.

4.7.3.2 *Suspension forks — tyre — clearance test*

For the tyre-clearance test, a suspension fork shall first be checked and adjusted if necessary, according to the following:

a) Inflate the Tyre to the maximum inflation pressure;

b) Place the fork in uncompressed condition to have the highest displacement between suspension stanchion legs and suspension lower legs;

c) If the suspension fork can be locked, place the fork in the open position;

d) If the fork has a spring adjust device, place it in the softest position;

e) If the fork has a pneumatic device, inflate the one or the two chambers at their minimum pressures according the manufacturer's instruction; and

f) If the fork has are bound device, place it on the slowest position.

With a wheel and tyre assembly fitted to the fork, apply a force of 2 800 N to the wheel in a direction towards the fork-crown and parallel to the axis of the fork steerer. Maintain this force for 1 minute.

4.7.3.3 *Suspension forks — tensile test*

When tested by the method described in **4.7.3.3.1**, there shall be no detachment or loosening of any parts of the assembly and the tubular, telescopic components of any fork-leg shall not separate under the test force.

4.7.3.3.1 *Test method*

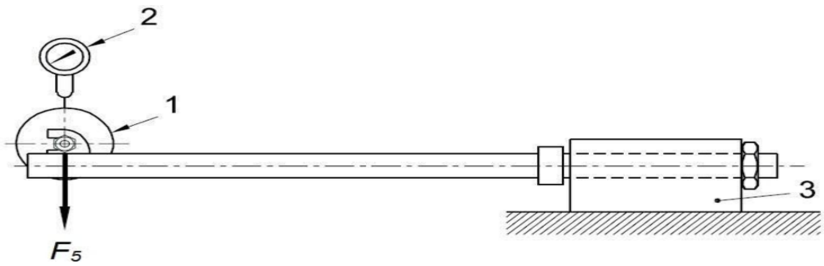
Mount the fork steerer securely in a suitable rigid mount, keeping any clamping forces away from the fork-crown, and apply a tensile force of 2 300 N distributed equally between the two dropouts in a direction parallel to the axis of the fork steerer and in the direction away from the Fork crown. Maintain this force for 1 minute.

4.7.4 *Front Fork — Static Bending Test*

When tested by the method described in **4.7.4.1**, there shall be no fractures or visible cracks in any part of the Fork, and the permanent deformation, measured as the displacement of the axis of the wheel axle, or simulated axle in relation to the axis of the fork steerer, shall not exceed 10 mm. For general crack detection methods, *see* Annex E.

4.7.4.1 *Test method*

Mount the fork according to Annex G and fit a loading attachment and swivel on an axle located in the axles lots of the blades (*see* Fig. 42). Locate a deflection measuring device over the loading attachment in order to measure deflection and permanent deformation of the fork perpendicular to the steerer axis and in the plane of the wheel.



Key

1 Loading attachment swivel on axle;

2 Deflection measuring device; and

3 Rigid mount incorporating head bearings.

FIG. 42 FRONT FORK — STATIC BENDING TEST (TYPICAL ARRANGEMENT)

Apply a static, pre-loading force of 100 N to the roller perpendicular to the steerer axis, against the direction of travel, and in the plane of the wheel. Remove and repeat this loading until a consistent deflection reading is obtained. Adjust the deflection measuring device to zero.

Increase the static force to $F5$ and maintain this force for 1 minute, then reduce the force to 100 N and record any permanent deformation. The forces are given in Table 20.

Table 20 Forces on Loading Attachment
(*Clause* 4.7.4.1)

Sl No.	Bicycle Type	City and Trekking/ Roadster/SLR Bicycles	Young Adult Bicycles	Mountain Bicycles	Racing Bicycles
(1)	(2)	(3)	(4)	(5)	(6)
i)	Force, F5, (N)	1 000	1 000	1 500	1 200

4.7.5 *Front Fork — Rearward Impact Test*

4.7.5.1 *Forks made entirely of metal*

When tested by the method described in **4.7.5.2.1**, if there are any fractures or visible cracks in any part of the fork, and the permanent deformation, measured as the displacement of the axis of the wheel axle or simulated axle in relation to the axis of the fork steerer exceeds 45 mm, the fork shall be considered to have failed. For general crack detection methods, *see* Annex E.

If the fork meets the first test criteria, then it shall be subjected to a second test as described in **4.7.5.2.2** after which it shall exhibit no fractures. If the Fork meets the first and second test criteria, then it shall be subjected to a third test as described in **4.7.5.2.3,** irrespective of the amount of permanent deformation, there shall be no relative movement between the steerer and the crown.

4.7.5.2 *Test methods*

4.7.5.2.1 *Test method 1*

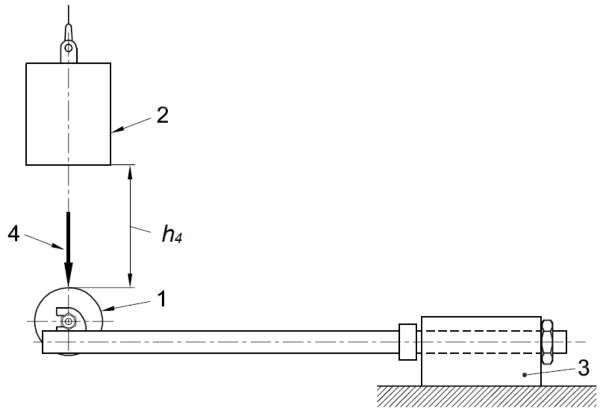
Mount the fork according to Annex G as shown in Fig. 43. Assemble a roller of mass less than or equal to 1 kg and with dimensions conforming to those shown in Fig. 44 in the fork. The hardness of the roller shall be not less than 60 HRC at impact surface.

Rest a striker of mass 22.5 ± 0.1 kg on the roller in the fork dropouts such that it is exerting a force against the direction of travel and in the plane of the wheel. Position a deflection measuring device under the roller and record the position of the roller in a direction perpendicular to the axis of the fork steerer and in the plane of the wheel and note the vertical position of the fork.

Remove the deflection measuring device, raise the striker through a height of $h4$, and release it to strike the roller against the rake of the fork. The drop heights are given in Table 21. The striker will bounce and this is normal. When the striker has come to rest on the roller, measure the permanent deformation under the roller *see* also Annex H.

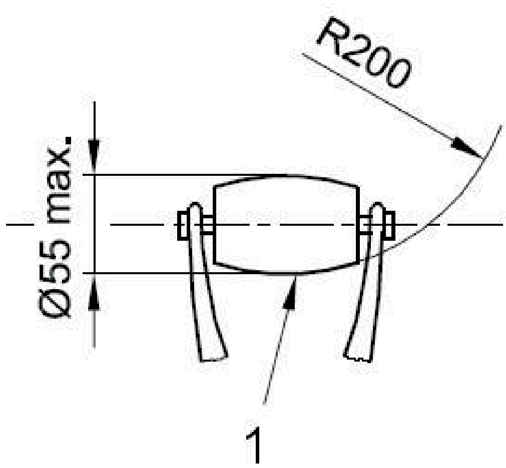
Table 21 Drop Heights
(*Clause* 4.7.5.2.1 *and* 4.7.6.1)

Sl No.	Bicycle Type		City and Trekking/ Roadster/SLR Bicycles	Young Adult Bicycles	Mountain Bicycles	Racing Bicycles
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Drop height, h4 (mm)	Forks, made entirely of metal	180	180	360	360
ii)	Drop height, h4 (mm)	Forks which have composite parts	320	320	600	640



Key
*h*4 Drop height;
1 Low-mass roller (1 kg max.);
2 22.5 kg striker;
3 Rigid mount incorporating head bearings; and
4 Direction of rearward impact.

FIG. 43 FRONT FORK — REARWARD IMPACT TEST



Key
1 Low-mass roller (1kg *Max*)

FIG. 44 LOW – MASS ROLLER

4.7.5.2.2 *Test method 2*

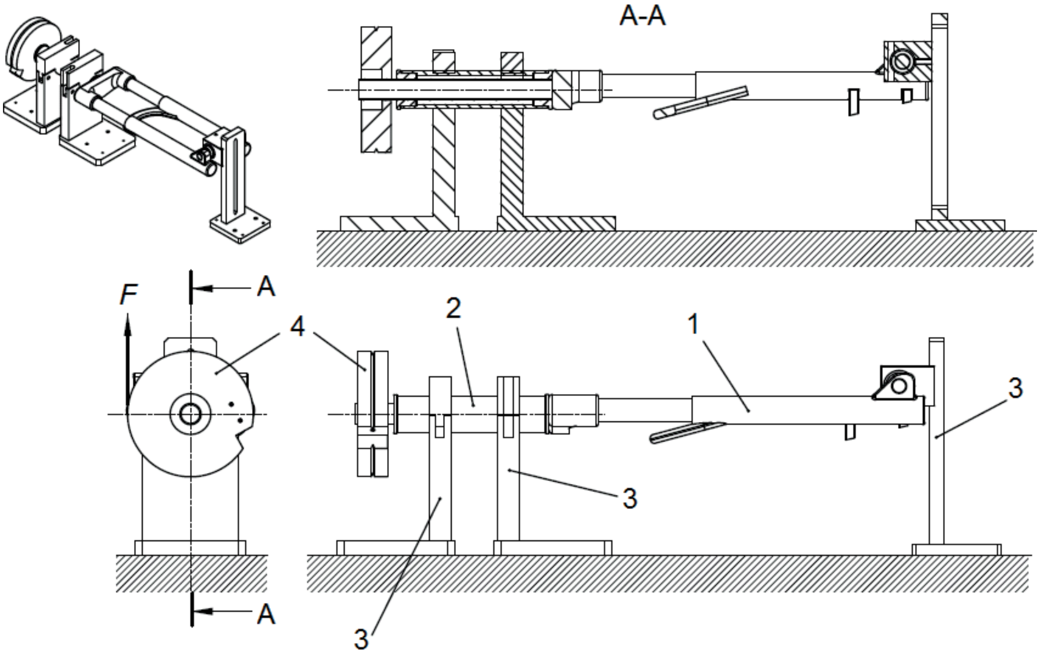
This test is similar to that described in **4.7.5.2.1** except the dropping height. As shown in Fig. 43, mount the fork used for the test in **4.7.5.2.1** and assemble a low-mass roller in the fork. Raise the striker to a height of 600 mm above the roller and release it to strike the roller against the rake of the fork. The section applies to forks in **4.7.5.1**.

4.7.5.2.3 *Test method 3*

Apply a torque of *T* to the assembly and maintain for 1 minute in each direction of possible rotation about the steerer axis. The torque is given in Table 22, and a typical example of test equipment is illustrated in Fig. 45.

Table 22 Torque on Fork
(*Clause* 4.7.5.2.3)

Sl No.	Bicycle Type	City and Trekking/ Roadster/SLR Bicycles	Young Adult Bicycles	Mountain Bicycles	Racing Bicycles
(1)	(2)	(3)	(4)	(5)	(6)
i)	Torque, T, (*Nm*)	50	50	80	80



Key
1 Front fork;
2 Fork mounting fixture (fixture representative of the head tube);
3 Rigid mount; and
4 Test adaptor.

FIG. 45 FORK STEERER TORSIONAL TEST (A TYPICAL EXAMPLE)

4.7.5.3 *Forks which have composite parts*

When tested by the method described in **4.7.5.2.1**, there shall be no fractures in any part of a fork, and the permanent deformation, measured as the displacement of the axis of the wheel axle or simulated axle in relation to the axis of the Fork steerer, shall not exceed 45 mm. If the fork meets the first test criteria, then it shall be subjected to a second test as described in **4.7.5.2.2**, torque on fork, irrespective of the amount of permanent deformation, there shall be no relative movement between the steerer and the crown.

4.7.6 *Front fork — Bending Fatigue Test Plus Rearward Impact Test*

When tested by the method described in **4.7.6.1**, there shall be no fractures in any part of the fork, and the permanent deformation, measured as the displacement of the axis of the wheel axle or simulated axle in relation to the axis of the fork steerer, shall not exceed 45 mm. For composite forks, the running displacement (peak-to-peak value) at the points where the test forces are applied shall not increase by more than 20 percent of the initial values of displacement (peak to peak value) taken after 1 000 cycles and before 2 000 cycles

4.7.6.1 *Front fork — bending fatigue test and rearward impact test*

Mount the fork according to Annex G as shown in Fig. 46.

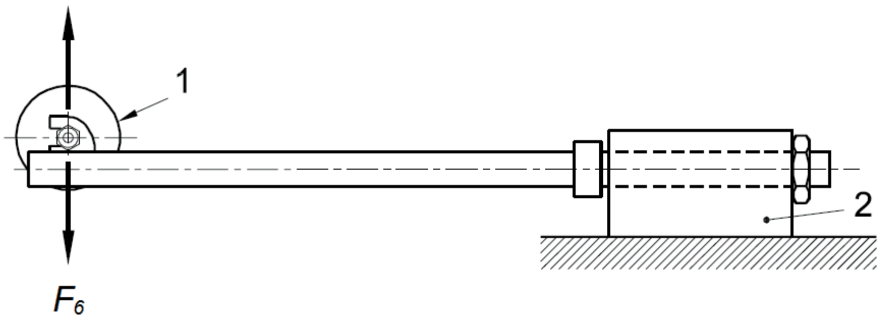
Apply cycles of fully reversed, dynamic forces of $F6$ in the plane of the wheel and perpendicular to the fork steerer tube to a loading attachment and swivel on an axle located in the axle-slots of the blades for 100 000 test cycles. The forces are given in Table 23. The maximum test frequency shall be maintained as specified in **5.3**.

Conclude the test if the running displacement (peak-to-peak value) at the point where the test forces are applied increases by more than 20 percent for rigid forks or more than 40 percent for suspension forks from the initial values of displacement (peak to peak value) taken after 1 000 cycles and before 2 000 cycles. Stop the test after 100 000 cycles and inspect the sample carefully for fractures. If fractures are found, conclude the test.

If the sample completes 100 000 cycles without exceeding the displacement limits noted above, and if no fractures can be observed, perform the Impact Resistance test described in **4.7.5.2.1** (the drop heights are given in Table 21). When the striker has come to rest on the roller, measure the permanent deformation under the roller and inspect the sample carefully for fractures.

Table 23 Forces on Loading Attachment
(*Clause* 4.7.6.1)

Sl No.	Bicycle Type	City and Trekking/ Roadster/SLR Bicycles	Young Adult Bicycles	Mountain Bicycles	Racing Bicycles
(1)	(2)	(3)	(4)	(5)	(6)
i)	Force, F_6, (N)	± 450	± 450	± 650	± 620



Key
1 Pivoted force attachment; and
2 Rigid mount incorporating head bearings.

FIG. 46 FRONT FORK — BENDING FATIGUE TEST

4.7.7 *Forks Intended for Use with Hub or Disc-Brakes*

4.7.7.1 *Static brake — torque test*

When tested by the method described in **4.7.7.2**, there shall be no fractures or visible cracks in any part of the fork, and the permanent deformation, measured as the displacement of the axis of the wheel-axle or simulated axle in relation to the axis of the Fork steerer, shall not exceed 5 mm for rigid Forks or 10 mm for suspension forks. For general crack detection methods, *see* Annex E.

4.7.7.1.1 *General*

When a fork is intended for use with a hub or disc brake and whether supplied as original equipment or as an accessory, the fork manufacturer shall provide an attachment point on the fork blade for the torque arm or caliper. In tests conducted by the methods described in **4.7.7.2** and **4.7.7.3** and where more than one mounting point is provided for a hub or disc brake, the following shall apply:

a) Where a complete bicycle is supplied, the test adaptor shall be secured to the mounting point used on the bicycle. If bracket will be supplied, it shall be used to perform the test; and

b) Where a fork is supplied as an accessory with more than one mounting point, separate tests shall be conducted on each of the mounting points on separate forks.

4.7.7.2 *Fork for hub/disc brake — static brake-torque test*

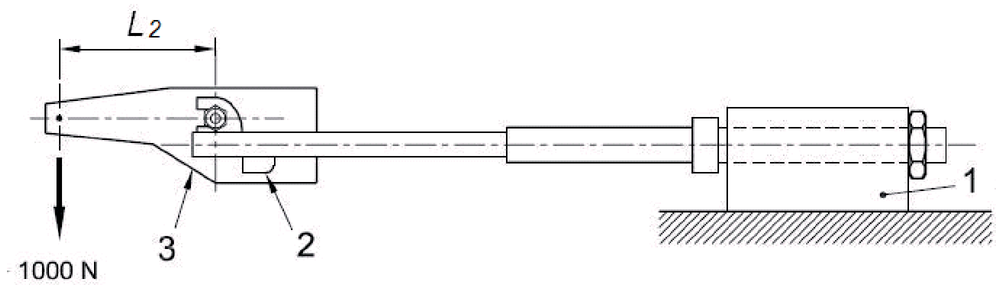
Mount the fork in a fixture representative of the head tube according to Annex G and gripped in the normal head-bearings, fit an axle to the fork, and mount on the axle a pivoted, straight adaptor as shown in Fig. 47 to provide a torque arm of L_2 in length (*see* Table 24) and a suitable attachment for the brake mounting point. If the wheel size is not listed in Table 24, the length L_2 shall be equal to one-half of the wheel diameter.

Locate a deflection-measuring device on the fork at the hub axis in order to measure deflection and permanent deformation of the fork perpendicular to the fork steerer axis and in the plane of the wheel. Apply a static pre-loading rearward force of 100 N to the end of the torque arm, perpendicular to the fork steerer axis and in the plane of the wheel.

Remove and repeat this loading until a consistent deflection reading is obtained. Adjust the deflection measuring device to zero. Apply a rearward force of 1 000 N to the torque arm perpendicular to the fork steerer axis and in the plane of the wheel. Maintain this force for 1 min, then reduce the force to 100 N and record any permanent deformation.

Table 24 Fixture Length
(*Clause* 4.7.7.2 *and* 4.7.7.3)

Sl No.	Bicycle Type	City and Trekking/ Roadster/SLR Bicycles	Young Adult Bicycles	Mountain Bicycles	Racing Bicycles
(1)	(2)	(3)	(4)	(5)	(6)
i)	Wheel diameter	24″	26″	650b	29″ or 700 c
ii)	Arm length, L_2,(mm)	305	330	349	368



Key
1 Rigid mount incorporating head bearings;
2 Brake mounting point; and
3 Test adaptor.

FIG. 47 FORK FOR HUB/DISC BRAKE — STATIC BRAKE-TORQUE TEST

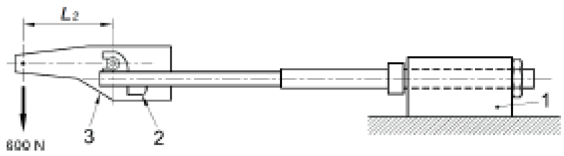
4.7.7.3 *Fork for hub/disc brake — brake mount fatigue test*

Mount the fork in a fixture representative of the head tube according to Annex G and gripped in the normal head-bearings, fit an axle to the fork, and mount on the axle a pivoted, straight adapt or as shown in Fig. 48 to provide a torque arm of $L2$ in length (*see* Table 24) and a suitable attachment for the brake mounting point.

Apply repeated, horizontal, dynamic forces of 600 N rearward to the end of the torque arm parallel to the plane of the wheel (as shown in Fig. 45) for $C2$ cycles (*see* Table 25). The maximum test frequency shall be maintained as specified in **5.3**.

Table 25 Minimum Test Cycles
(*Clause* 4.7.7.3)

Sl No.	Bicycle Type	City and Trekking/ Roadster/SLR Bicycles	Young Adult Bicycles	Mountain Bicycles	Racing Bicycles
(1)	(2)	(3)	(4)	(5)	(6)
i)	Test cycles, C_2, (numbers)	12 000	12 000	12 000	20 000



Key

1 Rigid mount incorporating head bearings;
2 Brake mounting point; and
3 Test adaptor.

FIG. 48 FORK FOR HUB/DISC-BRAKE — BRAKE MOUNT FATIGUE TEST

4.7.8 *Tensile Test for a Non-Welded Fork*

4.7.8.1 *General*

This test is for forks where the blades and/or the fork steerer are secured in the fork-crown by press-fitting, clamping, adhesives or any method other than brazing or welding. It can be convenient to combine this test with the wheel retention test in **4.7.4**.

4.7.8.2 *Requirement*

When tested by the method described in **4.7.8.3**, there shall be no detachment or loosening of any parts of the assembly.

4.7.8.3 *Tensile test for a non-welded fork*

Mount the fork steerer securely in a suitable rigid mount, keeping any clamping forces away from the fork- crown, and apply a tensile force of 5 000 N distributed equally to both drop outs for 1 minute in a direction parallel to the axis of the fork steerer.

4.8 Wheels and Wheel/Tyre Assembly

4.8.1 *Wheels/Tyre Assembly — Concentricity Tolerance and Lateral Tolerance*

The run-out shall not exceed the values which are given in Table 26.

Table 26 Wheel/Tyre Assembly — Concentricity and Lateral Tolerance
(*Clause* 4.8.1)

Sl No.	Bicycle Type		City and trekking/ Roadster/SLR Bicycles	Young Adult Bicycles	Mountain Bicycles	Racing Bicycles
(1)	(2)		(3)	(4)	(5)	(6)
i)	Concentriity and lateral tolerance (mm)	Intended for rim-brakes other than steel rim.	1	1	1	0.7
ii)		Not intended for rim brakes	2	2	2	
iii)		Intended for steel rim brakes	2	2	2	

4.8.2 *Rotational Accuracy*

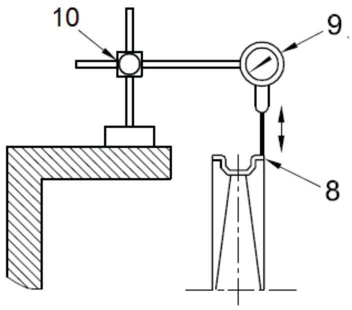
The run-out tolerances represent the maximum variation of the position of the rim when measured perpendicular to the axle at a suitable point along the rim (*see* Fig. 49 and Fig. 50) (that is., full indicator reading) of a fully assembled and adjusted wheel during one complete revolution about the axle without axial movement. Both sides of the rim shall be measured and the maximum value shall be taken as result.

For city and trekking/roadster/SLR, mountain and young adult bicycles, the measurement of both axial run-out (lateral) and radial run-out (concentricity) shall be done with a tyre fitted and inflated to the maximum inflation pressure but for rims where concentricity cannot be measured with the tyre fitted, it is permissible to make measurements with the tyre removed.

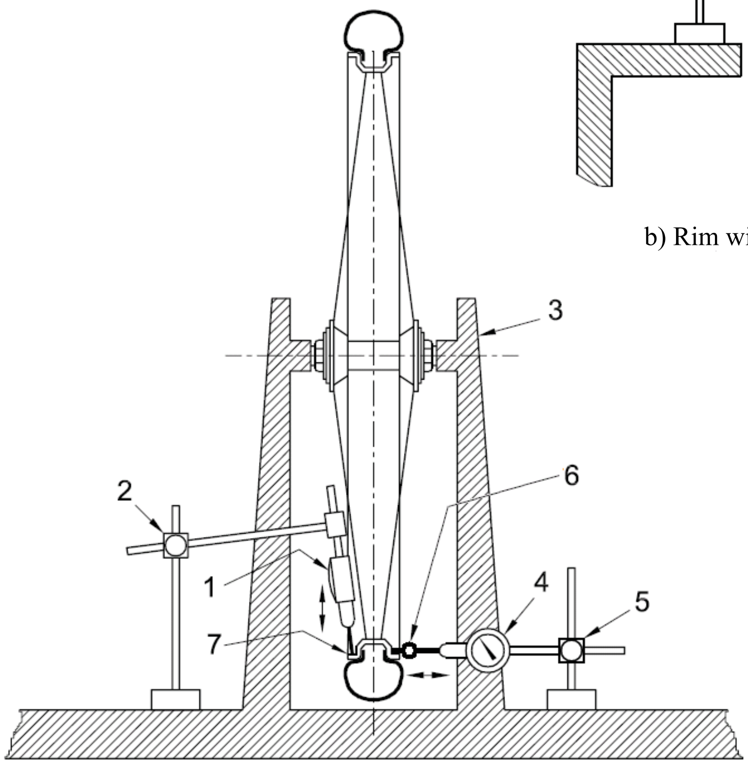
For racing bicycles/SLR, the measurements of both axial run-out (lateral) and radial run-out (concentricity) shall

be measured at the same time as shown in Fig. 50 and a tyre is not required to be fitted.

Where a bicycle has a frame or a fork with a suspension system, the values in Table 27 apply to the suspension system in its uncompressed state. Clearance requirements for the frame or fork under a load are specified in Annex F and **4.7.3.1**.



b) Rim without tyre

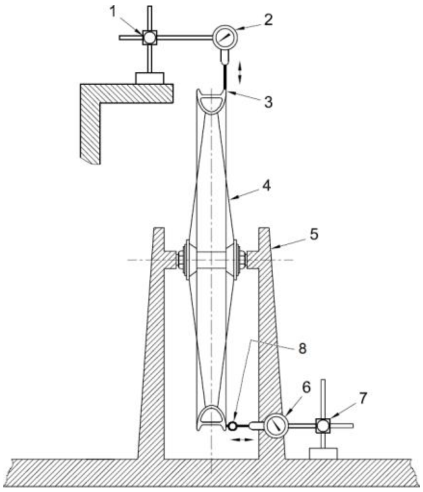


a) Rim with tyre; and

Key

1 Dial-gauge (concentricity);
2 Instrument stand;
3 Hub axle support;
4 Dial-gauge (lateral run-out);
5 Instrument stand;
6 Roller indicator;
7 Rim with tyre;
8 Rim without tyre;
9 Dial-gauge (concentricity; alternative position); and
10 Instrument stand.

FIG. 49 WHEELS/TYRE ASSEMBLY— ROTATIONAL ACCURACY FOR CITY AND TREKKING/ROADSTER /SLR YOUNG ADULT, AND MOUNTAIN BICYCLES



Key

1 Instrument stand;
2 Dial-gauge (concentricity);
3 Rim;
4 Spoke;
5 hub axle support;
6 dial-gauge (lateral run- out);
7 Instrument stand; and
8 Roller indicator.

FIG. 50 WHEEL — ROTATIONAL ACCURACY FOR RACING BICYCLES

Table 27 Wheel/Tyre Assembly — Clearance
(*Clause* 4.8.2)

Sl No.	Bicycle Type	City and Trekking/ Roadster/SLR Bicycles	Young Adult Bicycles	Mountain Bicycles	Racing Bicycles
(1)	(2)	(3)	(4)	(5)	(6)
i)	Clearance (mm)	6	6	6	4

4.8.3 *Wheel/Tyre Assembly — Static Strength Test*

There shall be no failure of any of the components of the wheel, and the permanent deformation, measured at the point of application of the force on the rim, shall not exceed the values which are given in Table 28.

Table 28 Values of Permanent Deformation
(*Clause* 4.8.3)

Sl No.	Bicycle Type	City and Trekking/ Roadster/SLR Bicycles	Young Adult Bicycles	Mountain Bicycles	Racing Bicycles
(1)	(2)	(3)	(4)	(5)	(6)
i)	Permanent deformation (mm)	1.5	1.5	1.0	1.0

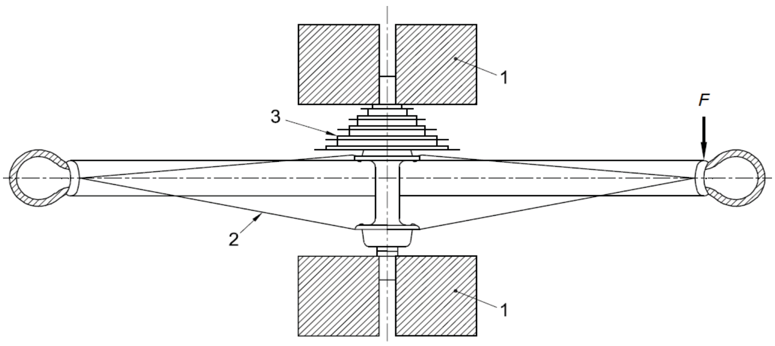
4.8.3.1 *Wheel/tyre assembly — Static strength test — Test method*

Clamp and support the wheel suitably as shown in Fig. 51. Apply a pre-load of 5 *N* on the rim at one spoke perpendicular to the plane of the wheel as shown in Fig. 51. Record the zero position of the rim at the point of load application as shown. Then apply a static force of *F* given in Table 29 for duration of 1 minute. Reduce the load to 5 *N* and allow a 1 min settling time. After this settling time and with the 5 *N* load still applied, re-measure the position of the rim.

The Wheel shall be fitted with the appropriate size Tyre and inflated to the Maximum Inflation Pressure. In the case of a rear wheel, apply the force from the sprocket side of the wheel as shown in Fig. 51. Repeat the above measurement once between two spokes. *See* Annex K for fatigue testing.

Table 29 Forces on Rim
(*Clause* 4.8.3.1)

Sl No.	Bicycle Type	City and Trekking/ Roadster/SLR Bicycles	Young Adult Bicycles	Mountain Bicycles	Racing Bicycles
(1)	(2)	(3)	(4)	(5)	(6)
i)	Force, F, (N)	250	250	370	250



Key
1 Clamping fixture;
2 Wheel/tyre assembly; and
3 Drives sprockets.

FIG. 51 WHEEL/TYRE ASSEMBLY— STATIC STRENGTH TEST

4.8.4 *Wheels — Wheel Retention*

4.8.4.1 *General*

Wheel retention safety is related to the combination of wheel, retention device, and drop-out design.

Wheels shall be secured to the bicycle frame and fork such that when adjusted to the manufacturer's instructions they comply with **4.8.4.2, 4.8.4.4** and **4.8.4.5.** Wheel nuts shall have a minimum removal torque of 70 percent of the manufacturer's recommended tightening torque. Where quick-release axle devices are used they shall comply with **4.8.4.5**.

4.8.4.2 *Wheel retention — Retention devices secured*

When tested by the method described in **4.8.4.3**, there shall be no relative motion between the axle and the front fork/frame.

4.8.4.3 *Wheels — Front/rear wheel retention devices secured — Test method*

Apply a force of 2 300 N distributed symmetrically to both ends of the axle for a period of 1 minute in the direction of the removal of the front and rear wheel independently.

4.8.4.4 *Front wheel retention — Retention devices unsecured*

A bicycle shall be equipped with secondary retention system that retains the front wheel in the drop- outs when the primary retention system is in the open (unlocked) position.

Where threaded axles and nuts are fitted, and the nuts are unscrewed by at least 360° from the finger tight condition and the brake system is disconnected or released, the wheel shall not detach from the front fork when a force of 100 *N* is applied radially outwards, in line with the drop-out slots, and maintained for 1 minute.

Where quick-release is fitted, and the quick-release lever is fully open and the brake system is disconnected or released, the wheel shall not detach from the front fork when a force of 100 *N* is applied to the wheel radially outwards, in line with the drop-out slots, and maintained for 1 minute.

4.8.4.5 *Wheels — quick-release devices — operating features*

Any quick-release device shall have the following operating features:

a) It shall be adjustable to allow setting for tightness;

b) Its form and marking shall clearly indicate whether the device is in the open or locked position;

c) If adjustable by a lever, the force required to close a properly set lever shall not exceed 200 N and, at this closing force, there shall be no permanent deformation of the quick-release device;

d) The releasing force of the clamping device when closed shall not be less than 50 N;

e) If operated by a lever, the quick-release device shall withstand without fracture or permanent deformation a closing force of not less than 250 N applied with the adjustment set to prevent closure at this force;

f) The wheel retention with the quick-release device in the clamped position shall be in accordance with **4.8.4.2**;

g) The front wheel retention with the quick-release device in the open position shall be in accordance with **4.4.4.4**; and

h) Wheel retention with the quick-release mechanism in the clamped position shall be in accordance with **4.8.4.2** and **4.8.4.3**.

If applied to a lever, the forces specified in (c), (d), and (e) shall be applied 5 mm from the tip end of the lever.

4.8.5 *Rims, Tyres, and Tubes*

4.8.5.1 *General*

Non-pneumatic tyres are excluded from the requirements of **4.8.5.2, 4.8.5.3** and **4.8.5.4.** For wheel/tyre assembly fatigue test for city and trekking/roadster/SLR bicycles, *see* Annex K.

4.8.5.2 *Tyre inflation pressure*

The maximum inflation pressure recommended by the manufacturer shall be permanently marked on the side wall of the tyre so as to be readily visible when the latter is assembled on the wheel. If the rim manufacturer recommends a maximum tyre inflation pressure, it shall be clearly and permanently marked on the rim and also specified in the manufacturer's instructions.

NOTE — It is recommended that the minimum inflation pressure specified by the tyre manufacturer also be permanently marked on the side wall of the tyre.

4.8.5.3 *Tyre and rim compatibility*

Tyres that comply with the requirements of ISO 5775-1 and rims that comply with the requirements of ISO 5775-2 are compatible. The tyre, tube and tape shall be compatible with the rim design. When inflated to 110 percent of the maximum inflation pressure, determined by the lower value between maximum inflation pressures recommended on the rim or the Tyre, for a period of not less than 5 minute, the tyre shall remain intact on the rim.

4.8.5.4 *Tubular tyres and rims*

Tubular tyres shall be compatible with the rim design. Instructions for the correct gluing technique shall be given in the bicycle or the wheel assembly instructions of the manufacturer's instructions [*see* **6.4**(v)].

4.8.5.4.1 *Rim-wear*

In the case where the rim forms part of a braking system and there is a danger of failure due to wear, the manufacturer shall make the rider aware of this danger by durable and legible marking on the rim, in an area not obscured by the tyre [*see* **6.4**(u)].

Where the rim is made of composite materials, the manufacturer shall include in the manufacturer's instructions warnings of the danger of rim failure caused by wear of the braking surfaces.

NOTE — A symbol referring to the instruction manual is an acceptable marking for rims for wear.

4.8.6 *Greenhouse Effect Test for Composite Wheels*

4.8.6.1 *General*

This requirement is to ensure wheels made from composite materials that are subjected to high temperature conditions (that is, such as car storage in direct sunlight) do not suffer concealed damage that could subsequently affect the safety

performance of the wheel during normal use.

4.8.6.2 *Requirement*

When a fully assembled wheel made of composite material, fitted with the appropriate size tyre and inflated according to the lower value between maximum inflation pressure recommended on the rim or the tyre, is tested by the method described in **4.8.6.3**, there shall be:

a) No failure of any of the components of the Wheel;
b) No tyre separation from the rim during the test;
c) No increase in rim width greater than 5 percent of the initial maximal width value;
d) Compliance of lateral and concentricity tolerance according to **4.8.1**;
e) Compliance of tyre and rim compatibility according to **4.8.5.3**; and
f) Compliance of static strength according to **4.8.3**.

4.8.6.3 *Test method*

A fully assembled wheel, fitted with the appropriate size tyre and inflated according to the lower value between maximum inflation pressure recommended on the rim or the tyre, shall be controlled before the test; lateral run-out has to be controlled according to **4.8.1** and maximum widths of the rim have to be reported.

A specific bench as shown in Fig. 52 could be used to measure the maximum width all around the rim with tyre and pressure (continuous measuring).

The wheel is laid down on the ground of a climate chamber, which has been pre-heated at 80 °C, lean ton axle and tyre support points, sprocket side of the Wheel, as shown in Fig. 53, during 4 h. At the end of 4 h, the wheel should be taken out of the climate chamber and allowed to cool down at room temperature during 4 h to re-measuring the rim width and its conformance to **4.8.6.1** and **4.8.6.2.**

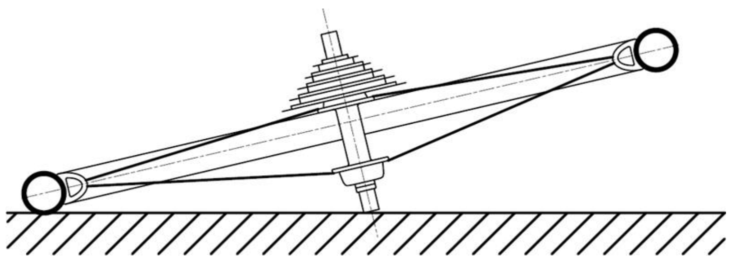


FIG. 52 WHEEL LAID DOWN ON TIRE AND AXLE

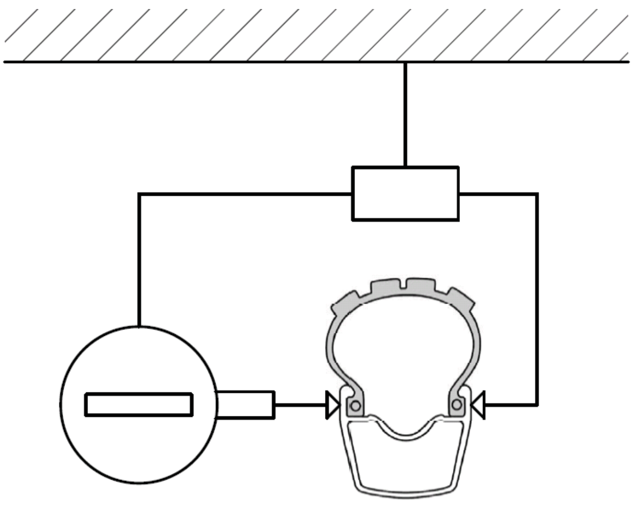


FIG. 53 MAXIMUM RIM'S WIDTH MEASURING

4.9 Saddles and Seat-Posts

4.9.1 *Limiting Dimensions*

No part of the saddle, saddle supports, or accessories to the saddle shall be more than 125 mm above the top saddle surface at the point where the saddle surface is intersected by the seat-post axis.

4.9.2 *Seat-Post — Insertion-Depth Mark or Positive Stop*

The seat-post shall be provided with one of the two following alternative means of ensuring a safe insertion depth into the frame.

a) It shall contain a permanent, transverse mark of length not less than the external diameter or the major dimension of the cross section of the seat-post that clearly indicates the minimum insertion depth of the seat-post into the frame. For a circular cross section, the mark shall be located not less than two diameters of the seat-post from the bottom of the seat-post (that is, where the diameter is the external diameter). For a non-circular cross section, the insertion-depth mark shall be located not less than 65 mm from the bottom of the seat-post (that is, where the seat-post has its full cross section); and

b) It shall incorporate a permanent stop to prevent it from being drawn out of the frame such as to leave the insertion less than the amount specified in (a) above.

4.9.3 *Saddle/Seat-Post – Security Test*

4.9.3.1 *Saddles with adjustment — clamps*

When tested by the method described in **4.9.3.4**, there shall be no movement of the saddle adjustment clamp in any direction with respect to the seat-post, or of the seat-post with respect to the frame, or any failure of saddle, adjustment clamp, or seat-post. If the saddle design is such that it cannot accurately test the saddle/seat-post clamp, it shall be possible to use a fixture which is representative of the saddle dimensions.

4.9.3.2 *Saddles without adjustment clamps*

Saddles that are not clamped, but are designed to pivot in a vertical plane with respect to the seat-post, shall be allowed to move within the parameters of the design and shall with stand the tests described in **4.9.3.4** without failure of any components.

4.9.3.3 *General*

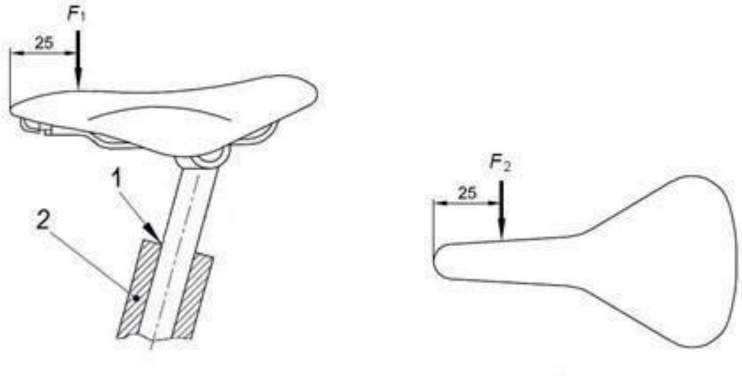
If a suspension seat-post is involved, the test can be conducted with the suspension system either free to operate or locked. If it is locked, the pillar shall be at its maximum length.

4.9.3.4 *Test Method*

With the seat-post correctly assembled to the bicycle Frame at minimum insertion depth of the seat-post (as specified in **4.9.2**) and the clamps tightened to the torque recommended by the bicycle manufacturer, apply a force of $F1$ vertically downwards at a point 25 mm from either the front or rear of the saddle, whichever produces the greater torque on the saddle clamp. The saddle shall be positioned in the Seat- post clamp assembly as defined by the saddle manufacturer's rail markings or instructions. Maintain this force for 1 minute. Remove this force and apply a lateral force of $F2$ horizontally at a point 25 mm from either the front or rear of the saddle and maintain this force for 1 minute, whichever produces the greater torque on the clamp (*see* Fig. 54). The forces are given in Table 30. The fixture shall be such that it does not damage the surface of the Saddle.

Table 30 Forces On Saddle
(*Clause* 4.9.3.4)

Sl No.	Bicycle Type	City and Trekking/ Roadster/SLR Bicycles	Young Adult Bicycles	Mountain Bicycles	Racing Bicycles
(1)	(2)	(3)	(4)	(5)	(6)
i)	Vertical force, $F1$, (N)	650	650	650	650
ii)	Horizontal force, $F2$, (N)	250	250	250	250



All dimensions are in millimeter

a) Vertical force b) Horizontal force

Key

1 Minimum insertion-depth mark; and
2 Bicycle frame.

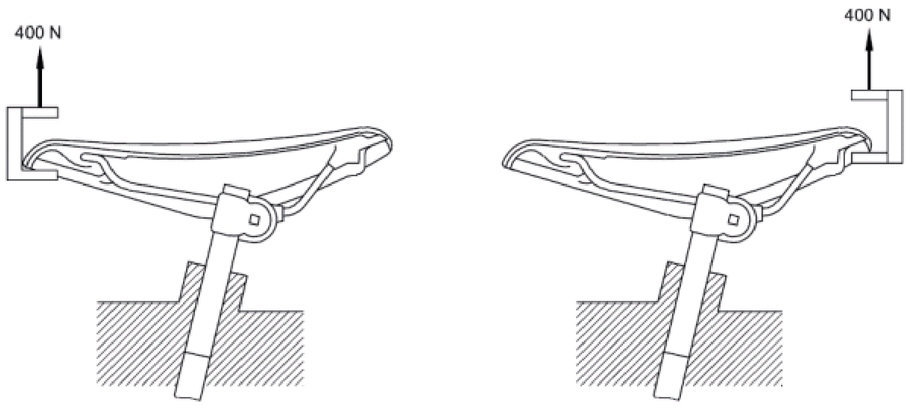
FIG. 54 SADDLE/SEAT-POST – SECURITY TEST

4.9.4 *Saddle — Static Strength Test*

When tested by the method described in **4.9.4.1**, the saddle cover and/or plastic moulding shall not disengage from the chassis of the saddle, and there shall be no cracking or permanent distortion of the Saddle assembly. For general crack detection methods, *see* Annex E.

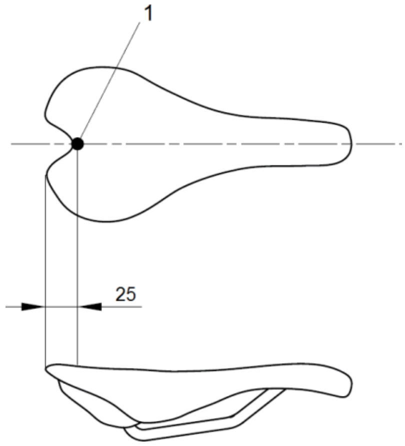
4.9.4.1 *Test Method*

Position the saddle in its maximum rearward direction as defined by the saddle manufacturer's rail markings or instructions, into a suitable fixture representative of a seat-post clamp assembly. Tighten the clamps to the torque recommended by the bicycle manufacturer, and apply forces of 400 N in turn under the rear and nose of the saddle cover, as shown in Fig. 55, ensuring that the force is not applied to any part of the chassis of the saddle. The load application point is on the longitudinal plane of the saddle at 25 mm from the back (front) of the saddle. If the saddle design is such that it cannot accept a center line load application, the load shall be symmetrically applied at two points of the saddle. Loading on the rear of the saddle shall be symmetrical about its longitudinal axis, as shown in Fig. 56.



a) Force under nose b) Force under rear

FIG. 55 SADDLE — STATIC STRENGTH TEST



Key
1 Loading point.

All dimensions are in millimeters

FIG. 56 SADDLE — LOAD APPLICATION POINT OF STATIC STRENGTH TEST

4.9.5 *Saddle and Seat-Post Clamp — Fatigue Test*

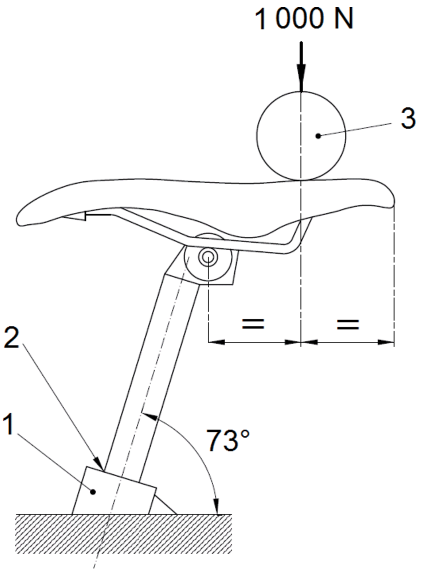
When tested by method described in **4.9.5.2**, there shall be no fractures or visible cracks in the seat-post or in the saddle, and no loosening of the clamp. For general crack detection methods, *see* Annex E.

4.9.5.1 *General*

Seat-posts can influence test failures of saddles. For this reason, a saddle shall be tested in combination with a seat-post as recommended by the saddle manufacturer.

4.9.5.2 *Test method*

Insert the seat-post to its minimum insertion depth (as specified in 4.9.2) in a rigid mount representative of that on the bicycle and with its axis at 73° to the horizontal. The saddle shall be positioned in the seat-post clamp assembly in a maximum rearward direction as defined by the saddle manufacturer's rail markings or instructions. Adjust the saddle to have its upper surface in a horizontal plane and tighten the clamp to the torque recommended by the bicycle manufacturer. Apply a repeated, vertically-downward force of 1 000 N for 200 000 cycles, in the position shown in Fig. 57, by means of a pad 300 mm long × 80 mm diameter to prevent localized damage of the saddle cover. The maximum test frequency shall be maintained as specified in **5.3**.



Key
1 Rigid mount;
2 Minimum insertion-depth mark; and
3 Pad (length = 300 mm, diameter = 80 mm).

FIG. 57 SADDLE AND SEAT-POST CLAMP — FATIGUE TEST

4.9.6 *Seat-Post — Fatigue Test*

Conduct the test in two stages on the same assembly as per **4.9.6.3** and **4.9.6.5**.

4.9.6.1 *Requirement for stage 1*

4.9.6.1.1 *Seat-post without suspension system*

When tested by the method described in **4.9.6.3**, there shall be no visible cracks or fractures in the Seat-post, or any bolt failure. For general crack detection methods, *see* Annex E. For composite seat-post, the running displacement (peak-to-peak value) at the point where the test forces are applied shall not increase by more than 20 percent of the initial value of displacement (peak to peak value) taken after 1 000 cycles and before 2 000 cycles.

4.9.6.1.2 *Seat-post with suspension system*

When tested by the method described in **4.9.6.3**, there shall be no visible cracks or fractures in the seat-post, or any bolt failure. The design shall be such that in the event of failure of the suspension system, the two main parts do not separate, nor does the upper part (that is, the part to which the saddle would be attached) become free to swivel in the lower part. For general crack detection methods, *see* Annex E.

4.9.6.2 *General*

In the following test, if a Suspension seat-post is involved, the test shall be conducted with the suspension system adjusted to give maximum resistance.

4.9.6.3 *Test method for stage 1(fatigue test)*

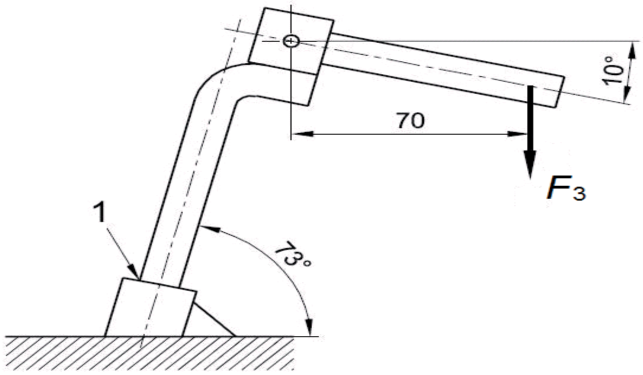
A seat-post shall be inserted to the minimum insertion depth (as specified in **4.9.2**) in a suitable fixture with a representative seat collar and clamped to the manufacturer’s recommended torque. The seat-post shall be fixed at an angle of 73° from horizontal, as shown in Fig. 58.

Secure an extension-bar to the saddle attachment point by the appropriate attachment fitting such that the bar extends rearwards and downwards at an angle of 10° below the horizontal to permit the application of a vertical test force at a distance of 70 mm from the centre of the saddle clamp where the center line of the clamp intersects the axis of the bar, as shown in Fig. 58.

Apply a repeated, vertically downward, dynamic force of $F3$ to the point described above and shown in Fig. 58 for 100 000 cycles. The forces are given in Table 31. The maximum test frequency shall be maintained as specified in **5.3**.

Table 31 Forces on Seat-Post
(*Clause* 4.9.6.3)

Sl No.	Bicycle Type	City and Trekking/ Roadster/SLR Bicycles	Young Adult Bicycles	Mountain Bicycles	Racing Bicycles
(1)	(2)	(3)	(4)	(5)	(6)
i)	Force, *F*3, (N)	1 000	1 000	1 200	1 200



Key
1 Minimum insertion-depth mark.

All dimensions are in millimeters

FIG. 58 SEAT-POST — FATIGUE TEST

4.9.6.4 *Requirement for stage 2*

4.9.6.4.1 *Seat-post without suspension system*

When tested by the method described in **4.9.6.5** there shall be no fractures and the applied forces shall be accurate to within percent of their nominal values, as determined by suitable means of displacement shall not exceed 10 mm during testing. For general crack detection methods, *see* Annex E.

4.9.6.4.2 *Seat-post with suspension system*

When tested by the method described in **4.9.6.5**, there shall be no fractures. The design shall be such that in the event of failure of the Suspension system, the two main parts do not separate, nor does the upper part (that is, the part to which the saddle would be attached) become free to swivel in the lower part. For general crack detection methods, *see* Annex E.

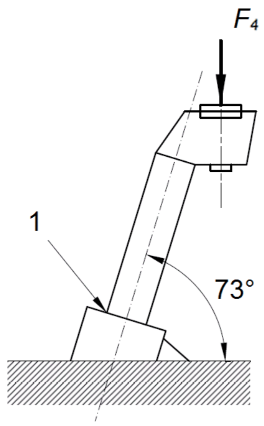
4.9.6.5 *Test method for stage 2 (static strength test)*

A Seat-post shall be inserted to the minimum insertion-depth (as specified in **4.9.2** in a suitable fixture with a representative seat collar and clamped to the manufacturer's recommended torque. The seat-post shall be fixed at an angle of 73° from the horizontal, as shown in Fig. 59.

A Force of F4 shall be exerted vertically on the saddle clamp for a duration of 1 minute. The displacement at the loading point shall be constantly monitored during testing. The forces are given in Table 32.

Table 32 Forces on Seat-Post
(*Clause* 4.9.6.5)

Sl No.	Bicycle Type	City and Trekking/ Roadster/SLR Bicycles	Young Adult Bicycles	Mountain Bicycles	Racing Bicycles
(1)	(2)	(3)	(4)	(5)	(6)
i)	Force, $F4$, (N)	2 000	1 500	2 000	3 000



Key
1 Minimum insertion-depth mark.

FIG. 59 SEAT-POST — STATIC STRENGTH TEST

4.10 Pedals and Pedal/Crank Drive System

4.10.1 *Pedal Tread*

4.10.1.1 *Tread surface*

The tread surface of a pedal shall be secured against movement within the pedal assembly.

4.10.1.1.2 *Toe clips*

Pedals intended to be used without toe-clips, or for optional use with toe clips, shall have:

a) Tread surfaces on the top and bottom surfaces of the pedal;
b) A definite preferred position that automatically presents the tread surface to the rider’s foot; and
c) Pedals designed to be used only with toe clips or shoe-retention devices shall have toe clips or shoe retention devices securely attached and need not comply with the requirements of **4.10.1.1.2** (a) and (b).

4.10.2 *Pedal Clearance*

4.10.2.1 *Ground clearance*

With the bicycle unladen, the pedal at its lowest point and the tread surface of the pedal parallel to the ground and uppermost where it has only one tread surface, the bicycle shall be capable of being leaned over at an angle of $\theta 2$ from the vertical before any part of the pedal touches the ground. The values are given in Table 33.

When a bicycle is equipped with a suspension system, this measurement shall be taken with the suspension adjusted to the softest condition and with the bicycle depressed into a position such as would be caused by a rider weighing 80 kg (in case of young adult bicycles, apply 40 kg).

Table 33 Values of Angles for Ground Clearance
(*Clause* 4.10.2.1)

Sl No.	Bicycle Type	City and Trekking/ Roadster/SLR Bicycles	Young Adult Bicycles	Mountain Bicycles	Racing Bicycles
(1)	(2)	(3)	(4)	(5)	(6)
i)	Lean angle $\theta 2$ (degrees)	25	23	25	23

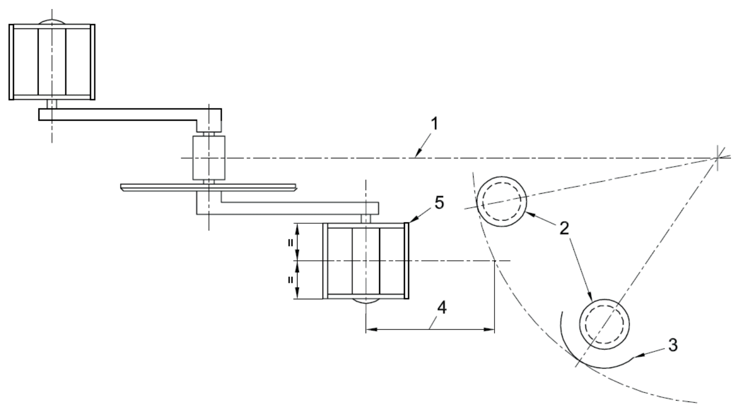
4.10.2.1.1 *Toe clearance*

Bicycles shall have at least *C* clearance between the pedal and front tyre or mudguard (when turned to any position). The clearance shall be measured forward and parallel to the longitudinal axis of the bicycle from the center of either pedal axle to the arc swept by the tyre or mudguard, whichever results in the least clearance (*see* Fig. 60). The values are given in Table 34.

Table 34 Values of Toe Clearance
(*Clause* 4.10.2.1.1)

Sl No.	Bicycle Type		City and Trekking/ Roadster/SLR Bicycles	Young Adult Bicycles	Mountain Bicycles	Racing Bicycles
(1)	(2)		(3)	(4)	(5)	(6)
i)	Toe clearance, C (mm)	Without foot retention	100	89	100	100
		With foot retention	89	89	89	89

NOTE — Foot retention system, for example, Quick release pedal or toe-clip.



Key

1 Longitudinal axis;
2 Front tyre;
3 Mudguard;
4 Clearance, *C*; and
5 Pedal.

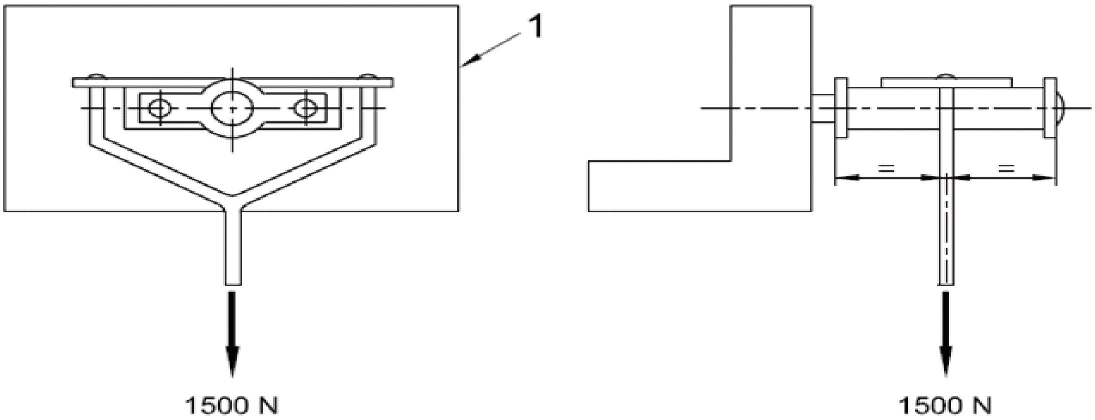
FIG. 60 PEDAL TO WHEEL/MUDGUARD — TOE CLEARANCE

4.10.3 *Pedal — Static Strength Test*

When tested by the method described in **4.10.3.1**, there shall be no fractures, visible cracks, or distortion of the pedal or spindle that could affect the operation of the pedal and pedal spindle. For general crack detection methods, *see* Annex E.

4.10.3.1 *Test method*

Screw the pedal-spindle securely into a suitable rigid fixture with its axis horizontal, as shown in Fig. 61, and apply a vertically downward force of 1 500 N for 1 minute to the centre of the pedal release the force and examine the pedal assembly and the spindle.



Key

1 Rigid mount.

FIG. 61 PEDAL/PEDAL-SPINDLE ASSEMBLY — STATIC STRENGTH TEST

4.10.4 *Pedal — Impact Test*

When tested by the method described in **4.10.4.1**, there shall be no fractures of any part of the pedal body, the pedal spindle, or any failure of the bearing system.

4.10.4.1 *Test method*

Screw the pedal-spindle securely into a suitable rigid fixture with its axis horizontal as shown in Fig. 62 and release a striker of the design shown in Fig. 63 and mass of 15 kg from a height of 400 mm to strike the pedal at the centre of the pedal. The width of the striker shall be wider than the width of the tread surface *see* also Annex H.

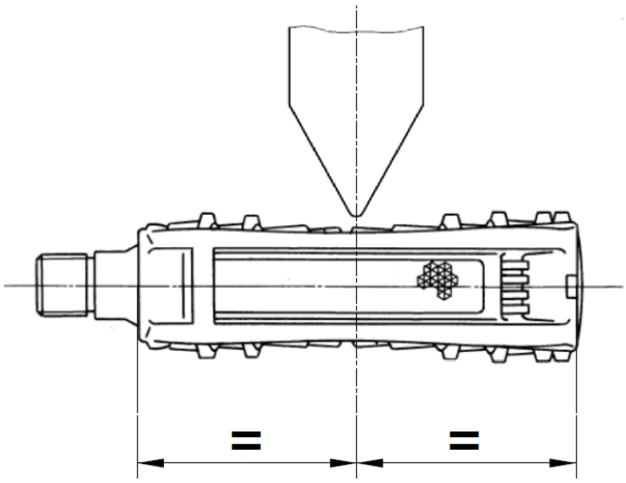
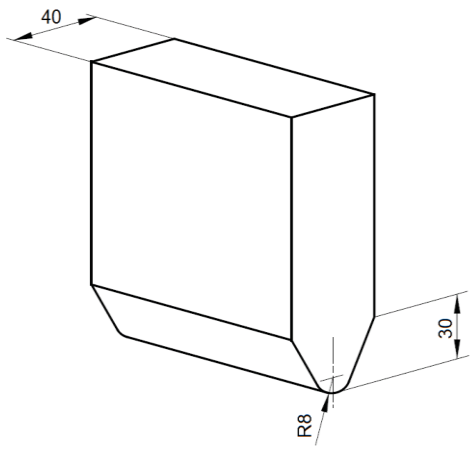


FIG. 62 POSITION OF IMPACT



All dimensions are in millimeters

FIG. 63 STRIKER DIMENSIONS

4.10.5 *Pedal—Dynamic Durability Test*

When subjected to test, there shall be no fractures or visible cracking of any part of the pedal, the pedal spindle, pedal spindle threads or any failure of the bearing system. For general crack detection methods, *see* Annex E.

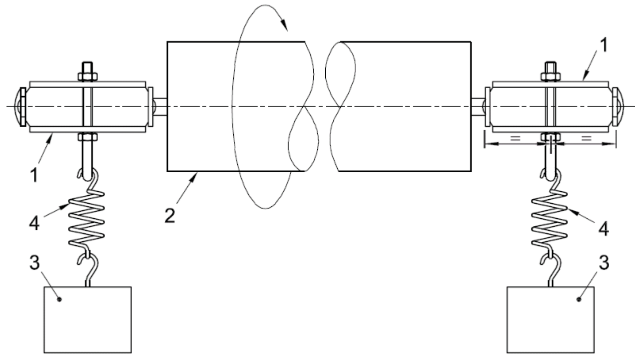
4.10.5.1 *Test method*

Screw each pedal securely into a threaded hole in a rotatable test shaft as shown in Fig. 64 and suspend a mass of *M* at the centre of the pedal width by means of a tension spring to each pedal, the object of the springs being to minimize oscillations of the load. The masses are given in Table 35.

Drive the shaft at a speed not exceeding 100 min^{-1} for a total of 100 000 revolutions. If the pedals are provided with two tread surfaces, they shall be turned through 180° after 50 000 revolutions.

Table 35 Masses on Pedal
(*Clause* 4.10.5.1)

Sl No.	Bicycle Type	City and Trekking/ Roadster/SLR Bicycles	Young Adult Bicycles	Mountain Bicycles	Racing Bicycles
(1)	(2)	(3)	(4)	(5)	(6)
i)	Mass, *M* (kg)	80	80	90	90



Key
1 Pedal;
2 Test shaft;
3 Mass; and
4 Tension spring.

FIG. 64 PEDAL/PEDAL-SPINDLE — DYNAMIC DURABILITY TEST

4.10.6 *Drive System — Static Strength Test*

4.10.6.1 *Drive system with chain*

When tested, there shall be no fracture of any component of the drive system and drive capability shall not be lost.

4.10.6.1.1 *Test method for drive system with chain*

4.10.6.1.2 *General*

Conduct the drive system static load test on an assembly comprising the frame, pedals, transmission system, rear wheel assembly, and, if appropriate, the gear-change mechanism. Support the frame with the central plan ever tical and with the rear wheel held at the rim to prevent the wheel from rotating.

4.10.6.1.3 *Single-speed system*

With the non-drive side crank in the forward position, apply a force, F_1, increasing gradually to 1 500 N vertically downwards to the centre of the non-drive side pedal. Maintain this force for 1 minute.

Should the system yield or the drive-sprockets tighten, such that the crank rotates while under load to a position more than 30° below the horizontal, remove the test force, return the crank to the horizontal position or some appropriate position above the horizontal to take account of yield or movement, and repeat the test.

On completion of the test on the left-hand crank, repeat the test with the drive side crank in the forward position and with the force applied to the drive side pedal.

4.10.6.1.4 *Multi-speed system*

a) Conduct the tests described in **4.10.6.1.3**;

b) with the transmission correctly adjusted in its highest gear; and

c) Conduct the tests with the transmission correctly adjusted in its lowest gear but, where appropriate, with the maximum force, F_1, adjusted to suit the particular gear ratio. Thus, the maximum force, F1, shall be a function of the lowest gear ratio, Nc/Ns, where F1 is the force applied to the Pedal, expressed in newton (N); Nc is the number of teeth on the smallest chain wheel (front); Ns is the number of teeth on the largest sprocket (rear).

Where the ratio N_C/N_S has a value equal to or greater than 1, the force, F_1, shall be 1 500 N; but where the ratio N_C/N_S has a value less than 1, the force, F_1, shall be reduced in proportion to the lowest gear ratio. Thus:

F_1 is 1 500 × N_C/N_S

4.10.7 *Drive System with Belt*

When tested by the method described in **4.10.7.1**, there shall be no fracture of any component of the drive system and the belt shall not slip/skip, fracture, or cause any loss in drive capability. Smooth sliding between pulleys and belt is allowed at a rate not exceeding 1°/s at the drive axis.

4.10.7.1 *Test method for drive system with belt*

The sample in its fully finished condition (with teeth, if any) shall be submitted to a water spray conditioning equivalent to IPx4 as per IEC 60529 for 10 minute. Application of the loading shall be done within 20 minute after conditioning.

a) If the drive system is a single-speed system,

conduct the tests as described in **4.10.6.1.3.**

b) If the drive system is a multi-speed system, conduct the tests as described in **4.10.6.1.4.**

4.10.8 *Drive Belt — Tensile Strength Test*

Set up a fixture with two drive pulleys that are similar or identical as shown in Fig. 65. At least one pulley should be free to rotate. Increase the tensile load gradually until the tension load of the belt reaches 4 000 *N*.

NOTE — 4 000 N is the tension load within the belt and requires a load *F* of 8 000 *N* to achieve this tension load.

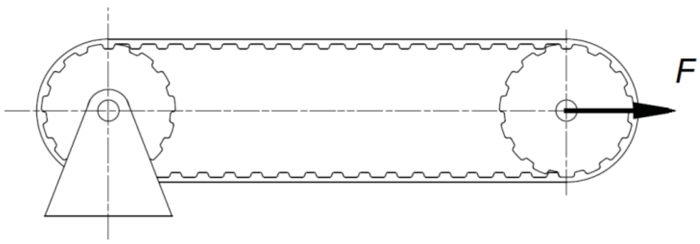


FIG. 65 DRIVE BELT — TENSILE STRENGTH TEST

4.10.9 *Crank Assembly —Fatigue Test*

4.10.9.1 *Requirement*

When tested by the method described in **4.10.9.3**, there shall be no fractures or visible cracks in the cranks, the bottom-bracket spindle, or any of the attachment features, or loosening or detachment of the chain wheel from the crank. For general crack detection methods *see* Annex E.

For composite cranks, the running displacements (peak-to-peak values) of either crank at the point where the test forces are applied shall not increase by more than 20 percent of the initial value of displacement (peak to peak value) taken after 1 000 cycles and before 2 000 cycles.

4.10.9.2 *General*

Two types of fatigue test are specified for mountain and racing bicycles:

a) the first test with the cranks positioned at 45° to the horizontal to simulate the forces due to pedalling; and

b) the second test with the cranks positioned at 30° to the horizontal, which has been found to simulate the forces due the rider standing on the pedals during the descent of hills.

The two tests shall be conducted on separate assemblies.

4.10.9.3 ***T****est method with the cranks at 45° to the horizontal*

Mount the assembly of the two pedal-spindle adaptors, the drive side and non-drive side crank, the chain wheel set (or other drive component), and the bottom-bracket spindle located on its normal-production bearings in a fixture with bearing housings representative of the bottom-bracket (as shown in Fig. 66). Incline the crank sat 45° to the horizontal.

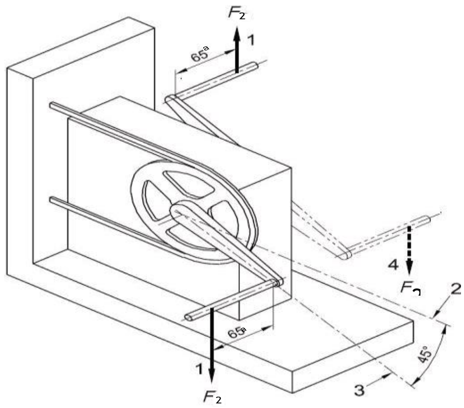
Prevent rotation by locating a suitable length of drive chain around the largest or only chain wheel and securing it firmly to a suitable support, or, for any other type of transmission (for example, belt or shaft-drive) by securing the first stage of the transmission.

NOTE — It is permissible to have the non-drive side crank in either of the two positions shown in Fig. 66, provided the test force is applied in the appropriate direction as specified in the next paragraph.

Apply repeated, vertical, dynamic forces of $F2$ alternately to the pedal-spindle adaptors of the drive side and non-drive side crank at a distance of 65 mm from the out board face of each crank (as shown in Table 36 and Fig. 66) for *C* test cycles (where one test cycle consists of the application of the two forces). The direction of the force on the drive side crank shall be downwards and that on the non-drive side crank shall be upwards for a rearward-pointing crank, or downwards for a forward- pointing crank. During application of these test forces, ensure that the force on a pedal-spindle adapt or falls to 5 percent or less of the peak force before commencing application of the test force to the other pedal-spindle adaptor. The maximum test frequency shall be maintained as specified in **5.3**.

Table 36 Forces on Pedal-Spindle and Test Cycles
(*Clause* 4.10.9.3)

Sl No.	Bicycle Type	City and Trekking/ Roadster/SLR Bicycles	Young Adult Bicycles	Mountain Bicycles	Racing Bicycles
(1)	(2)	(3)	(4)	(5)	(6)
i)	Force, *F*2 (N)	1 300	1 300	1 800	1 800
ii)	Test cycles, C At angle 45°	100 000	100 000	50 000	100 000
iii)	Test cycles, C At angle 30°	-	-	50 000	-



All dimensions are in millimeters

Key
1 Repeated test force;
2 Horizontal axis;
3 Axis of crank; and
4 Alternative left crank arrangement.

a) From outboard face of crank.

FIG. 66 CRANK ASSEMBLY — FATIGUE TEST WITH CRANKS AT 45° (TYPICAL TEST ARRANGEMENT)

4.10.9.4 *Special requirements for mountain bicycles*

For mountain bicycles, two types of fatigue test are specified:

a) one with the cranks positioned at 45° to the horizontal to simulate the forces due to Pedalling, and

b) the second test with the cranks positioned at 30° to the horizontal, which has been found to simulate the forces due to the rider standing on the pedals during the descent of hills.

The two tests shall be conducted on separate assemblies.

When tested by the method described in **4.10.9.4.1**, there shall be no fractures or visible cracks in the cranks, the bottom-bracket spindle or any of the attachment features, or loosening or detachment of the chain wheel from the crank. For general crack detection methods, see Annex E.

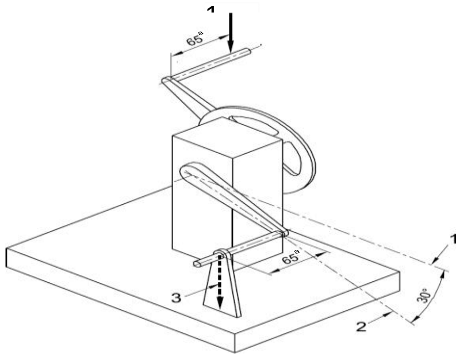
For composite cranks, the running displacements (peak-to-peak values) of either crank at the point where the test forces are applied shall not increase by more than 20 percent of the initial value of displacement (peak-to-peak value) taken after 1 000 cycles and before 2 000 cycles.

4.10.9.4.1 *Test method with the cranks at 30° to the horizontal for mountain bicycles*

Mount the assembly of the two pedal-spindle adaptors, the drive side and non-drive side crank, the chain wheel set (or other drive component), and the bottom-bracket spindle located on its normal-production bearings in a fixture with bearing housings representative of the bottom-bracket, as shown in Fig. 67. Incline the cranks at 30° to the horizontal as shown in Fig. 67. Restrain the non-drive side crank to the base of the test machine by a

device attached to the pedal-spindle at a distance of 65 mm from the outboard face of the crank.

Apply a repeated, vertically downward, dynamic force of 1 800 N to the pedal-spindle of the drive side crank at a distance of 65 mm from the out board face of the crank (as shown in Fig 67) for 50 000 cycles. The maximum test frequency shall be maintained as specified in **5.3**.



Key
1 Horizontal axis;
2 Axis of Crank;
3 Reactive force (equal and opposite to test force); and

All dimensions are in millimeters

a) From outboard face of the crank

FIG. 67 CRANK ASSEMBLY — FATIGUE TEST WITH CRANKS AT 30° (TYPICAL TEST ARRANGEMENT)

4.11 Drive-Chain and Belt Drive

4.11.1 *Drive–Chain*

Where a chain-drive is used as a means of transmitting the motive force, the chain shall operate over the front and rear sprockets without binding.

The chain shall conform to the requirements of IS 15511/ISO 9633.

4.11.2 *Belt Drive*

Where a belt-drive is used as a means of transmitting the motive force, the drive belt shall operate over the front and rear pulleys without binding. When tested by the methods described in **4.10.8**, there shall be no evidence of cracking, fracture, or delamination of the belt drive. For general crack detection methods, *see* Annex E.

4.11.3 *Chain-Wheel and Belt-Drive Protective Device*

4.11.3.1 *Requirements*

City and trekking/roadster/SLR and young adult bicycles shall be equipped with

a) A chain wheel discord drive pulley disc which conforms to **4.11.3.2**;

b) A chain and drive belt protective device which conforms to **4.11.3.3**; and

c) Where fitted with positive foot-retention devices on the pedals, a combined front gear-change guide which conforms to **4.11.3.4** shall be used.

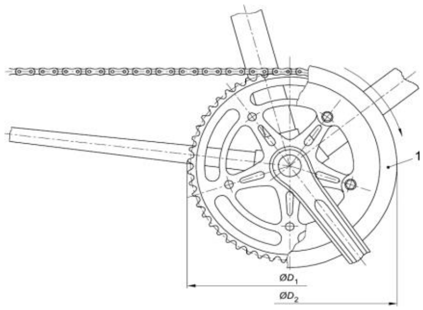
Mountain and racing bicycles shall be equipped with any one of the above.

4.11.3.2 *Chain-wheel disc and drive pulley disc diameter*

A chain-wheel disc shall exceed the diameter of the outer chain wheel, when measured a cross the tips of the teeth, by not less than 10 mm (*see* Fig. 68).

A drive pulley disc shall exceed the diameter of the front pulley, when measured across the tips of the teeth; by not less than 10 mm (*see* Fig. 69). Where the design is such that the crank and chain wheel are too close together to accommodate a full disc, a partial disc can be fitted which closely abuts the crank.

NOTE — Where the design is such that the pedal crank and chain wheel are too close together to accommodate a full disc, a partial disc may he fitted which closely abuts the pedal crank.

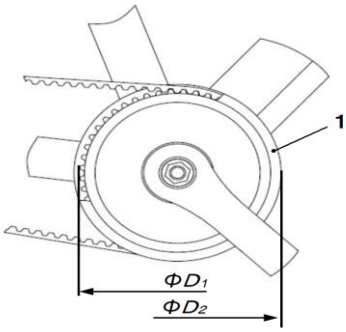


Key

1 Chain-wheel disc ($D_2 \geq D_1 + 10$)

All dimensions are in millimeter

FIG. 68 CHAIN-WHEEL DISC



Key

1 Drive pulley disc ($D_2 \geq D_1$ +10).

FIG. 69 DRIVE PULLEY DISC

4.11.3.3 *Chain and drive belt protective device*

A chain protective device shall, as a minimum, shield the side plates and top surface of the chain and the chain wheel for a distance of at least 25 mm rearwards along the chain from the point where the chain wheel teeth first pass between the side plates of the chain, and forwards round the outer chain wheel to a horizontal line passing through the bottom-bracket axle centre [*see* Fig.70 (a)].

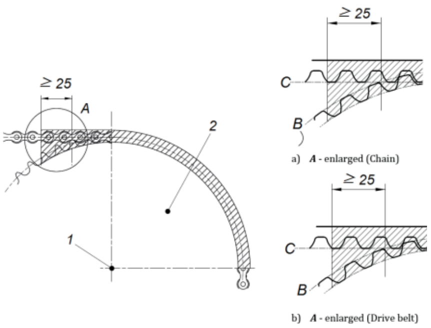
A drive belt protective device shall, as a minimum, shield the side and top surface of the drive belt and the front pulley for a distance of at least 25 mm rearwards along the drive belt from the point where the tip circle of the pulley [circle *B* in Fig. 70 (b)] is intersected by the tip line of the belt [line *C* in Fig. 70 (b)], and forwards round the front pulley to a horizontal line passing through the bottom-bracket axle centre [*see* Fig. 70 (b)].

4.11.3.4 *Combined front gear-change guide*

When the chain is located in the outer gear position, some portion of the combined front gear change guide shall be above the chain in the region 25 mm from the point where the chain wheel first passes between the side plates of the chain, parallel to the chain side plates in the direction towards the rear wheel of the bicycle (*see* Fig. 71).

In addition, some portion of the combined front gear change guide shall be present below the chain in the region beyond 25 mm from the point where the chain wheel first passes between the side plates of the chain, parallel to the chain side plates in the direction towards the rear wheel of the bicycle (*see* Fig. 71).

NOTE — It is recommended that the gap between front-gear and front gear-change guide specified by the manufacturer is properly set.

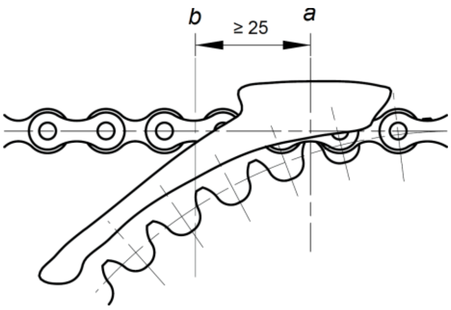


Key

1 Bottom-bracket axle centre;
2 Chain wheel or front pulley;
B Tip circle of the pulley; and
C Tip line of the belt.

All dimensions are in millimeters

FIG. 70 CHAIN AND DRIVE BELT PROTECTIVE DEVICE REQUIREMENTS (MINIMUM)



Key

a The point where the chain wheel first passes between the side plates of the chain; and

b 25 mm rearwards from the point where the chain wheel first passes between the side plates of the chain.

All dimensions are in millimeters

FIG. 71 CHAIN AND CHAIN-WHEEL JUNCTION

4.12 Spoke Protector

Bicycles for young adults as well as city and trekking/roadster/SLR bicycles with multiple free-wheel/cassette sprockets shall be fitted with a spoke-protector guard to prevent the chain from interfering with or stopping rotation of the wheel through improper adjustment or damage. All other types of bicycles covered by this part can be fitted with a spoke protector.

4.13 Luggage Carriers

If luggage carriers are fitted or provided, they shall comply with IS 14363/ISO 11243.

4.14 Warning Devices

Bell or other suitable audible warning device if fitted, shall comply with ISO 7636.

5 ADDITIONAL TESTS /REQUIREMENTS OF SUB-ASSEMBLIES

5.1 Brake Test and Strength Test

5.1.1 *Numbers and Condition of Specimens for the Strength Tests*

In general, for static, impact and fatigue tests each test shall be conducted on a new test sample, but if only one sample is available, it is permissible to

conduct all of these tests on the same sample with the sequence of testing being fatigue, static and impact.

When more than one test is conducted on the same sample, the test sequence shall be clearly recorded in the test report or record of testing. It should be noted that if more than one test is conducted on the same sample, earlier tests can influence the results of subsequent tests. Also, if a sample fails when it has been subjected to more than one test, a direct comparison with single testing is not possible. In all strength tests, specimens shall be in the fully finished condition.

5.1.2 *Accuracy Tolerances of Test Conditions for Brake Tests and Strength Tests*

Unless stated otherwise, accuracy tolerances based on the nominal values shall be as follows:

Forces and torques	0/ + 5%
Masses and weights	± 1%
Dimensions	± 1 mm
Angles	± 1°
Time duration	± 5 s
Temperatures	± 2 °C
Pressures	± 5%

5.2 Front Mudguard Test Methods

5.2.1 *Front Mudguard with Stays Test Methods*

5.2.1.1 *Stage 1: Test method — Tangential obstruction*

Insert a 12 mm diameter steel rod between the spokes, in contact with the rim and below the front mudguard stays as shown in Fig. 72 (a), and rotate the wheel to apply a tangentially upward force of 160 N, against the front mudguard stays; maintain this force for 1 minute.

Remove the rod and determine whether or not the wheel is free to rotate and whether or not any damage to the front mudguard adversely affects wheel rotation (blocking of the heel) and the steering.

5.2.1.2 *Stage 2: Test method — radial force*

Press the front mudguard at a distance of 20 mm from its free end (not taking the flap into consideration) with a 20 mm diameter, flat-ended tool radially towards the tyre with a force of 80 N as shown in Fig. 72 (b).

While the force is maintained, rotate the wheel manually in the direction of forward movement of the bicycle and determine whether or not the wheel is free to rotate, and whether or not any damage to the front mudguard adversely affects wheel rotation (blocking of the wheel) and the steering.

5.2.2 *Front Mudguard Without Stays Test Method*

Press the front mudguard at a distance of 20 mm from its free end with a 20 mm diameter, flat-ended tool radially towards the tyre with a force of 80 N as shown in Fig. 72 (b).

While the force is maintained, rotate the wheel manually in the direction off or ward movement of the bicycle and determine whether or not the front mudguard is rolled up the wheel, and whether or not any damage to the front mudguard adversely affects wheel rotation (blocking of the wheel) or obstructs the steering. Contact between tyre and mudguard is allowed.

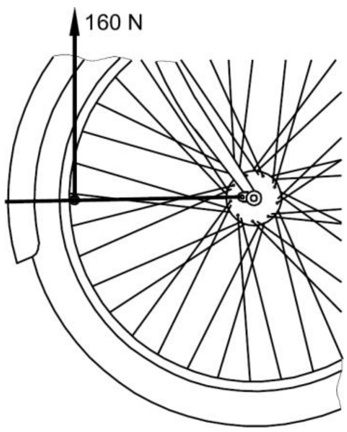
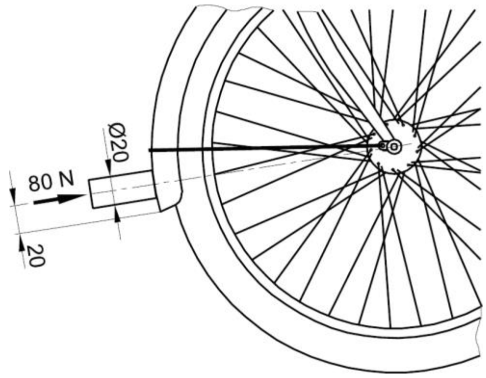


FIG. 72 (A) FRONT MUDGUARD — TANGENTIAL OBSTRUCTION TEST



All dimensions are in millimeter

FIG. 72 (B) FRONT MUDGUARD — RADIAL FORCE TEST

5.3 Fatigue Test

The force for fatigue tests is to be applied and released progressively, not to exceed 10 Hz. The tightness of fasteners according to manufacturer's recommended torque can be re-checked not later than 1 000 test cycles to allow for the initial settling of the component assembly. (This is considered applicable to all components, where fasteners are present for clamping). The test bench shall be qualified to meet the dynamic requirements of **5.1.2.**

5.4 Plastic Material Strength Tests at Ambient Temperature

All strength tests involving any plastic materials shall be pre-conditioned for 2 h and tested at an ambient temperature of 23 °C ± 5 °C.

6 REQUIREMENTS OF COMPLETE BICYLES

6.1 Road Test

6.1.1 *Test Requirement*

When tested by the method described in **6.1.2**, there shall be no system or component failure and no loosening or misalignment of the saddle, handlebar, controls, or reflectors.

The bicycle shall exhibit stable handling in braking, turning, and steering, and it shall be possible to ride with one hand removed from the handlebar (as when giving hand signals), without difficulty of operation or hazard to the rider. If the bicycle is fitted with a luggage carrier, the test shall be carried out with the maximum load capacity indicated on the luggage carrier *see* also **4.4.13.7** (h).

6.1.2 *Test Method*

First, check and adjust, if necessary, each bicycle selected for the road test to ensure that the steering and wheels rotate freely without slackness and that brakes are correctly adjusted and do not impede wheel rotation. Check and adjust wheel alignment and, if necessary, inflate tyres to the maximum inflation pressure. Check and correct, if necessary, transmission-chain adjustment, and check any gear controls for correct and free operation. Carefully adjust the saddle and handlebar positions to suit the rider.

The test shall be carried out with the permissible total weight specified by the manufacturer, *see* **6.4** (h). Ensure that the bicycle is ridden for at least 1 km.

6.2 Structural Integrity of a Fully Assembled Bicycle

For structural integrity of a fully assembled bicycle, machine test method as given in Annex K shall be carried out. After completion of the machine test, conduct a brief, simple track test with progressively increasing operating forces to determine whether or not the brakes bring the bicycle to a smooth, safe stop, *see* also **4.4.13.7** (h).

6.3 Folding Cycle Mechanism

Folding bicycle mechanism if provided, shall be so designed that the bicycle can be locked for use in a simple, stable, safe way, and when folded, no damage shall occur to any cables. No locking mechanism shall contact the wheels or tyres during riding, and it shall be impossible to unintentionally loosen or unlock the folding mechanisms during riding.

6.4 Manufacturer's Instructions

For guidance on usages and upkeep of bicycles, manufacturers shall provide suitable instructions to the users. These instructions may be provided in all types of formats (paper, CD, website, etc) shall be written in the language of the country where the bicycle is to be marketed, or by visual tools, such as pictograms and illustrations, which shall feature prominently in the product safety information. When an electronic format is provided, a paper version shall be available upon request. The customer shall be made aware of this information either by the manufacturer or the retailer. Instructions for use shall contain the following information:

a) The type of use for which the bicycle has been designed (that is, the type of terrain for which it is suitable) with a warning about the hazards of incorrect use;

b) Preparation for riding: how to measure and adjust the saddle height to suit the rider with an explanation of the insertion-depth warning marks on the seat-post and handlebar-stem. Clear information on which lever operates the front brake, which lever operates the rear brake, the presence of any brake-power modulators with an explanation of their function and adjustment, and the correct method of using a back-pedal brake if fitted;

c) Indication of minimum saddle height and the way to measure it;

d) The recommended method for adjusting any adjustable suspension system fitted;

e) Recommendations for safe riding, the use of a bicycle helmet, regular checks on brakes, tyre pressure, steering, rims, and caution concerning possible increased braking distances in wet weather;

f) An advisory note on specific risk of entrapment during normal use and maintenance;

g) The safe use and adjustment of foot-securing devices if fitted (that is, quick-release pedals and toe clips);

h) The permissible total weight of the rider plus luggage and the maximum total weight (bicycle + rider + luggage);

j) Indication of whether or not a bicycle is suitable for the fitting of a luggage carrier and/or a child seat;

k) Recommendation about usage for bicycle trailer or trailer bicycle if allowed by bicycle manufacturer;

m) An advisory note to draw attention to the rider concerning possible national legal requirements when the bicycle is to be ridden on public roads (that is, Llghting and reflectors);

n) Recommended tightening of fasteners related to the handlebar, handlebar stem, saddle, seat-post, wheels, and aerodynamic extension if fitted with torque values for threaded fasteners;

p) The method for determining the correct adjustment of quick-release devices, such as the mechanism should emboss the fork-ends when closed to the locked position;

q) The correct method of assembling any parts supplied unassembled;

r) Lubrication: where and how often to lubricate, and the recommended lubricants;

s) The correct chain tension and how to adjust it (if appropriate);

t) Adjustments of gears and their operation (if appropriate);

u) Adjustment of brakes and recommendations for the replacement of the friction components;

v) Recommendations on general maintenance;

w) Importance of using only genuine replacement parts for safety-critical components;

y) Care of the wheel rims and a clear explanation of any danger of rim wear (*see* **4.8.5.4.1**). For composite rims where wear damage can be invisible to the user, the manufacturer shall explain the consequences of rim wear and how the cyclist can assess the degree of wear or should recommend returning the composite rim to the manufacturer for inspection;

z) The correct gluing technique for wheels equipped with tubular tyres if fitted (*see* **4.8.5.4**);

aa) Appropriate spares, that is., tyres, tubes, and brake friction-components; and

ab) Accessories: where these are offered as fitted, details should be included such as operation, maintenance required (if any), and any relevant spares (for example, light bulbs).

ac) An advisory note to draw the attention of the Rider to possible damage due to intensive use and to recommend periodic inspections of the frame, fork, suspensions joints (if any), and composite components (if any). The wording of the advice can be as follows:

WARNING

As with all mechanical components, the bicycle is subjected to wear and high stresses. Different materials and components may react to wear or stress fatigue in different ways. Any form of crack, scratches or change of coloring in highly stressed areas indicate that the component is about to fail shortly and it should be replaced. This is necessary to avoid sudden failure while in use which may also result injuries to the rider.

For composite components, impact damage may be invisible to the user, the manufacturer shall explain the consequences of impact damage and that in the event of an impact; composite components should either be returned to the manufacturer for inspection or destroyed and replaced.

a) For composite components, an advisory note to draw attention to the influence of high temperature (heat radiations) in confined environment on composite materials (if appropriate);

b) For city and trekking/roadster/SLR bicycles, the importance of suitably covering any coil springs under the saddle if a child-seat is fitted to prevent trapping of fingers;

c) For racing bicycles, caution concerning possible reduction of toe-clearance due to replacement of cranks or tyres;

d) For racing bicycles, an advisory note to draw attention to the fact that when using an aerodynamic extension on the handlebar, the rider's response to steering and braking can be adversely affected; and

e) The maximum inflation pressure for a conventional or tubular tyre, according to the lower value between maximum inflation pressure recommended on the rim or the tyre .

Any other relevant information may also be included at the discretion of the manufacturer.

6.5 Marking Requirement

6.5.1 *Marking on Frame*

The frame shall be visibly and permanently marked with a successive frame number at a readily visible location such as near the pedal-crank, the seat-post, or the handlebar, and the name of the manufacturer of the complete bicycles or the manufacturer's representative and IS 10613.

NOTE — It is recommended that the maximum permissible load (rider plus luggage) is also marked at a readily visible location on the frame by the manufacturer.

6.5.2 *Marking on Other Components*

Currently there are no specific requirements, but it is recommended that the following safety-critical components be clearly and permanently marked with traceable identification, such as manufacturer's name and a part number:

a) Front fork;
b) Handlebar and handlebar stem;
c) Seat-post;
d) Brake levers, brake blocks, and/or brake-block holders;
e) Outer brake-cable casing;
f) Hydraulic-brake tubing;
g) Disc-brake calipers, brake-discs, and Brake pads;
h) Chain;
j) Pedals and cranks;
k) Bottom-bracket spindle;
m) Wheel rims.

6.5.3 *Method of Marking*

All permanent marking shall be done by punching of sufficient depth for easy reading. For certain components where marking by punching is not feasible, marking may be undertaken by printing or affixing label.

6.5.3.1 *Durability test of marking*

For checking durability of printed marking, rub the marking by hand for 15 s with a piece of cloth soaked in water and again for 15 s with a piece of cloth soaked in petroleum spirit. The marking shall remain easily legible.

If any label is used for any marking, it shall neither be easily removable nor show any sign of curling.

6.6 BIS Certification Marking

Each bicycle may also be marked with Standard Mark.

6.6.1 The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the Bureau of Indian Standards Act, 2016 and the Rules and Regulations framed there under, and the products may be marked with the Standard Mark.

ANNEX A

(*Clause* 2)

LIST OF REFERRED STANDARDS

IS/ISO/IEC/EN No.	*Title*
IS 1367 (Part 3) : 2017/ISO 898-1 : 2013	Technical supply conditions for threaded steel fasteners: Part 3 Mechanical properties of fasteners made of carbon steel and bolts, screws and studs (*fifth revision*)
IS 1367 (Part 6) : 1994/ISO 898-2 : 1992	Technical supply conditions for threaded steel fasteners: Part 6 Mechanical properties and test methods of nuts with specified proof loads (*fourth revision*)
ISO 3452-1 : 2021	Non-destructive testing — Penetrant testing — Part 1: General principles
ISO 3452-2 : 2021	Non-destructive testing — Penetrant testing — Part 2: Testing of penetrant materials
ISO 3452-3 : 2013	Non-destructive testing — Penetrant testing — Part 3: Reference test blocks
ISO 3452-4 : 1998	Non-destructive testing — Penetrant testing — Part 4: Equipment
ISO 4210 -2 : 2015	Cycles — Safety requirements for bicycles — Part 2: Requirements for City and trekking, young adult, mountain and racing bicycle
ISO 5775-1 : 2014	Bicycle tyres and rims — Part 1: Tyre designations and Dimensions

IS/ISO/IEC/EN No.	*Title*
ISO 5775-2 : 2021	Bicycle tyres and rims — Part 2: Rims
ISO 6742-1 : 2015	Cycles — Lighting and retro-reflective devices — Part 1: Lighting and light signalling devices
IS/ISO 6742-2 : 2015	Cycles — Lighting and retro-reflective devices — Part 2: Retro-reflective devices
ISO 7636 : 1984	Bells for bicycles and mopeds — Technical specifications
ISO 8124-1 : 2018	Safety of toys — Part 1: Safety aspects related to mechanical and physical properties
ISO 8124-3 : 2020	Safety of toys — Part 3: Migration of certain elements
IS 14363 : 2018	Cycles — Luggage carriers for bicycles — Requirements and test methods
IS 15511 : 2004/ISO 9633 : 2001	Cycle chains — Characteristics and test methods
IS 15533 : 2018/ISO 8098 : 3014	Safety requirements for Bicycles for young children *(first revision)*
IEC 60529 : 1989	Degrees of protection provided by enclosures (IP Code)

ANNEX B
(*Clause* 4.1.2)

TOXICITY TEST

B-1 PLASTIC COMPONENTS

Plastic components such as brake cable, grips, brake levers, pdals etc. shall be tested for total polycyclic aromatic Hydrocarbons (PAH) content and total phthalate content.

B-1.1 Total Polycyclic Aromatic Hydrocarbons (PAH) Content

Total polycyclic aromatic hydrocarbons (PAH) content shall be determined as per AFPS GS 2014 : 01 PAK-Analysis by GC-MSD for following 18 compounds:

Naphthalene (91-20-3),

Acenaphthylene (208-96-8),

Acenaphthene (83-32-9),

Fluorene (86-73-7),

Phenanthrene (85-1-8),

Anthracene (120-12-7),

Fluoranthene (206-44-0),

Pyrene (129-00-0),

Chrysene (218-01-9),

Benzo (a) Anthracene (56-55-3),

Benzo (b) Fluoranthene (205-99-2),

Benzo (k) Fluoranthene (207-08-9),

Benzo (j) Fluoranthene (205-82-3),

Benzo (e) Pyrene (192-97-2), Benzo (a) Pyrene (50-32-8),

Dibenzo (a, h) Anthrancene (53-70-3),

Indeno (1,2,3-cd)

Pyrene (193-39-5), Benzo (g, h, i) Perylene (191-24-2)

Samples tested shall meet the following requirements:

Total of 18 PAH's: ≤ 10 mg/kg and Benzo (a) pyrene: ≤ 1 mg/kg

NOTE — CAS number of compounds are given in brackets.

B-1.2 Total Phthalate Content

Total Ppthalate content shall be determined by Solvent Extraction followed by GC-MS Analysis. The amount of following 19 compounds shall be determined:

i) DEHP Bis (2-ethylhexyl)
ii) phthalate (117-81-7);
iii) DBP Dibutylphthalate (84-74-2);
iv) BBP Benzylbutylphthalate (85-68-7);
v) DINP Diisononylphthalate (28553-12-0, 68515-48-0);
vi) DIDP Diisodecylphthalate (26761-40-0);
vii) DNOP Dioctylphthalate (117-84-0);
viii) DIBP Diisobutylphthalate (84-69-5);
ix) DHNUP 1,2-Benzenedicarboxylic acid, di-C7-11-branched and linear alkyl esters (68515-42-4);
x) DIHP 1,2-Benzoldicarbonsäure, Di-C6-8-verzweigte Alkyl ester, C7-reich (71888-89-6);
xi) DMEP Dimethoxyethylphthalat (117-82-8);
xii) 1,2-Benzoldicarbonsäure, Dipentylester, verzweigt undlinear (84777-06-0);
xiii) DIPP Diisopentylphthalat (605-50-5);
xiv) nPIPP N-Lentil-isopentylphthalat (776297-69-9);
xv) DPP Dipentylphthalat (131-18-0);
xvi) DnHP Dihexylphthalate (84-75-3);
xvii) DHxP 1,2-Benzenedicarboxylic acid, dihexylester, branched and linear, (68515-50-4);
xviii) 1,2-Benzenedicarboxylic acid di-C6-10-alkyl esters; 1,2-Benzenedicarboxylic acid, mixed decyl and hexyl and octyldiesters with 0.3% of dihexyl phthalate, (68515-51-5, 68648-93-1);
xix) DCP dicylohexyl phthalate (84-61-7); and
xx) Di-n-pentyl phthalate (DNPP).

The presence of none of above compound shall exceed 0.1 percent.

NOTE — CAS number of compounds are given in brackets.

B-2 COATED METAL COMPONENTS

Metal components with coating such as metal tubes shall be subjected to determination of 19 elements for migration of heavy metal as per ISO 8124-3. The list of 19 elements along with their maximum migration allowed is given in Table 37. Samples are required to meet the migration content requirement of all the elements individually.

Table 37 Migration Limits of Heavy Metals

(*Clause* **B-2**)

Sl No.	**Element**	**Limit Max (mg/Kg)**
(1)	(2)	(3)
i)	Aluminum (Al)	70 000
ii)	Antimony (Sb)	560
iii)	Arsenic (As)	47
iv)	Barium (Ba)	18 750
v)	Boron (B)	15 000
vi)	Cadmium (Cd)	17
vii)	Chromium (III) (Cr III)	460
viii)	Chromium-Vi (Cr-vi)	0.2
ix)	Cobalt (Co)	130
x)	Copper (Cu)	7 700
xi)	Lead (Pb)	160
xii)	Manganese (Mn)	15 000
xiii)	Mercury (Hg)	94
xiv)	Nickel (Ni)	930
xv)	Selenium (Se)	460
xvi)	Strontium (Sr)	56 000
xvii)	Tin (Sn)	180 000
xviii)	Organotin	12
xix)	Zinc (Zn)	46 000

ANNEX C

(*Clauses* 4.4.11, 4.4.13.3 *and* 4.4.13.7(f))

METHOD OF LEAST SQUARES FOR OBTAINING THE LINE OF BEST-FIT AND ± 20 PERCENT LIMIT LINES FOR BRAKING PERFORMANCE LINEARITY

C-1 The readings taken in the test specified in **4.4** can be expected to lie near some straight line that can be drawn through them. Although in practice one might draw a good straight line through the points by eye, the method of least squares given here provides a criterion for minimizing the discrepancies and permits a line to be selected that has a claim to be called the best fit.

C-2 The line of best fit is the line that minimizes the sum of the squares of the differences between the observed results and the corresponding results predicted by the line.

C-3 The relationship between the variables is considered to be of the form:

$$y = a + bx \qquad \text{(B.1)}$$

where

x = Independent variable, and is known precisely (in this case, the load applied to the pedal); and

y = Dependent variable, and is observed but with a degree of uncertainty (in this case, the braking force at the wheel).

a and b= Unknown constants and have to be estimated.

For a series of n readings, this relationship can be resolved by taking a minimum of the sum of the squares of the difference to give.

$$b = \frac{n\sum xy - \sum x \sum y}{n\sum X^2 - (\sum X)^2} \qquad \text{(B.2)}$$

we know

$$\bar{y} = \frac{\sum y}{n} \text{ and } \bar{x} = \frac{\sum x}{n} \qquad \text{(B.3)}$$

$$b = \frac{\sum xy - \bar{y}\sum x}{\sum X^2 - \bar{x}\sum x} \qquad \text{(B.4)}$$

Then a can be found by substitution:

$$a = \bar{y} - b\bar{x} \qquad \text{(B.5)}$$

For example, the following four values of x and y are noted during a test, from which $\sum xy$ and $\sum x^2$ are determined besides $\bar{x}$ and $\bar{y}$ as shown below:

Sl No.	*x* *Pedal Force* *N*	*y* *Braking Force* *N*
1)	90	90
2)	150	120
3)	230	160
4)	300	220
Sum	$\sum x = 770$	$\sum y = 590$
Mean	$\bar{x} = 192.5$	$\bar{y} = 147.5$

Sl. No.	*Xy*	*x^2*
1	8 100	8 100
2	18 000	22 500
3	36 800	52 900
4	66 000	90 000
Sum	$\sum xy$=1,28,900	$\sum x^2$=1,73,500

$$b = \frac{\sum xy - \bar{y}\sum x}{\sum X^2 - \bar{x}\sum x}$$

$$= \frac{128\ 900 - (147.5 \text{ x } 770)}{173\ 500 - (192.5 \text{ x } 770)}$$

= 0.606

$$a = \bar{y} - b\bar{x}$$

= 147.5 – (0.606 × 192.5)

=30.8

The line of best fit is therefore

y = 30.8 + 0.60x

And the ± 20 percent limit lines are

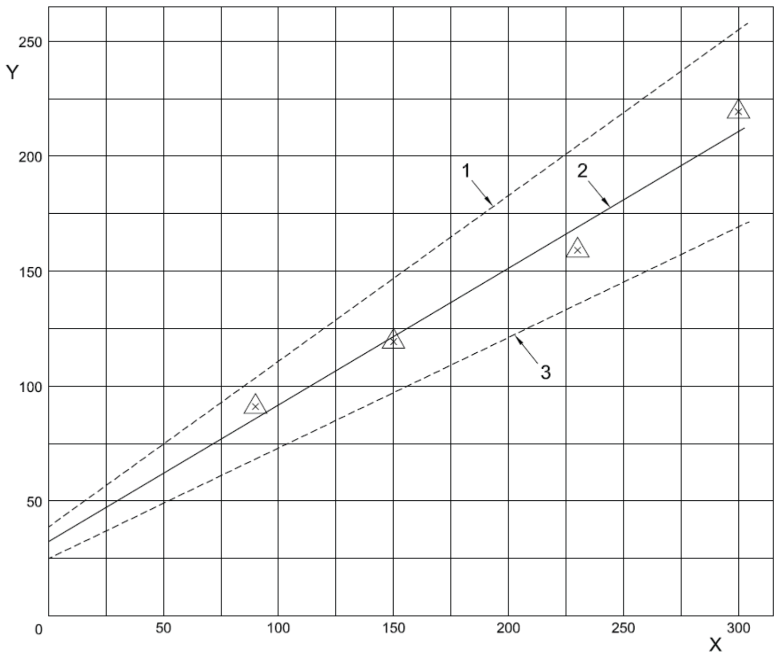
$$y_{lower} = \frac{80}{100}(30.8+0.606x)$$

$$= 24.64 + 0.485x$$

$$y_{upper} = \frac{120}{100}(30.8+0.606x)$$

$$= 36.96 + 0.727x$$

The results from the example are shown graphically in Fig. 73.



Key

Y Braking force, N;
X Input force, N;
1 +20 percent limit;
2 line of best fit; and
3 −20 percent limit.

FIG. 73 GRAPH OF LEVER FORCE OR PEDAL FORCE (INPUT FORCE) AGAINST BRAKING FORCE, SHOWING LINE OF BEST FIT AND ± 20 PERCENT LIMIT LINES

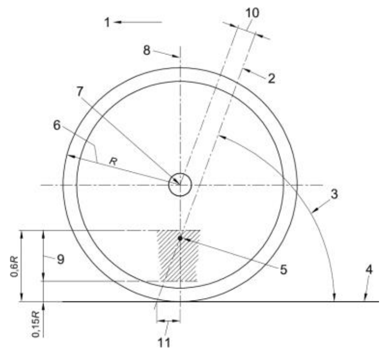
ANNEX D
(*Clause* 4.5.5)

STEERING GEOMETRY

D-1 The Steering geometry employed, as shown in Fig. 74, will generally be dictated by the use for which the bicycle is intended but it is nevertheless recommended that

a) The steering head angle be not more than 75° and not less than 65° in relation to the ground line; and

b) The steering axis intersects a line perpendicular to the ground line, drawn through the wheel center, at a point not lower than 15 percent and not higher than 60 percent of the wheel radius when measured from the ground line.



Key

1 Direction of travel;
2 Steering axis;
3 Steering head angle;
4 Ground line;
5 Intersection point;
6 Wheel radius;
7 Wheel centre;
8 Perpendicular to ground line;
9 Tolerance;
10 Offset; amd
11 Trail.

FIG. 74 STEERING GEOMETRY

ANNEX E

(*Clauses* 4.5.6.1.2, 4.5.6.2.2, 4.5.6.3.2, 4.5.6.3.3, 4.5.7.2, 4.6.2, 4.6,3, 4.6.4, 4.7.4, 4.7.5.1, 4.7.7.1, 4.9.4, 4.9.5, 4.9.6.1.1, 4.9.6.1.2, 4.9.6.4.1, 4.9.6.4.2, 4.10.3, 4.10.5, 4.10.9.1, 4.10.9.4 *and* 4.11.2)

GENERAL CRACK DETECTION METHODS

The detection of visible cracks after certain tests have been specified as criteria of failure. In cases cracks are not visible by naked eye but are suspected, suitable methods such as dye-penetrant methods as specified in ISO 3452-1, ISO 3452-2, ISO 3452-3 and ISO 3452-4 may be used to detect cracks. In addition, white Paint or surface treatment can be used to aid in detection for cracks pertaining to composite materials.

ANNEX F
(*Cause*s 4.6.1 *and* 4.8.2)

SUSPENSION FRAMES — TYRE CLEARANCE TEST

F-1 TEST REQUIREMENTS

When tested the tyre or any components other than fixing mechanism shall not contact the frame nor shall the components separate.

F-2 TEST METHOD

For the tyre-clearance test, a suspension frame and wheel shall first be checked and adjusted according to the following:

a) Inflate the tyre to the maximum inflation pressure;
b) If the frame's suspension element can be locked, place it in the open position; and
c) If the frame's suspension element is a pneumatic shock, pressurize the chamber to the minimum pressure according to the manufacturer's instruction.

Secure the frame in an orientation that allows a force to be applied to the wheel from a simulated ground plane. With a wheel and tyre assembly fitted to the frame, apply a force of 2 800 N to the wheel in a direction perpendicular to the simulated ground plane such that the suspension is compressed (*see* Fig. 75). Maintain the force for 1 minute.

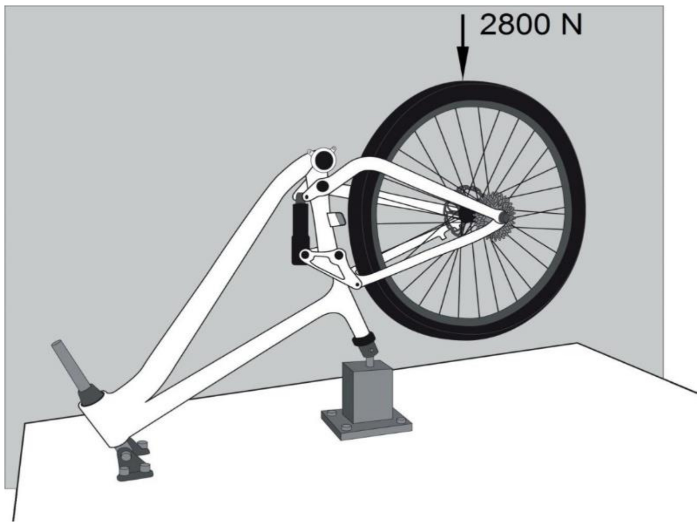


FIG. 75 EXAMPLES OF SUSPENSION FRAMES — TYRE-CLEARANCE TEST

ANNEX G

(*Clauses* 4.6.2, 4.6.2.1, 4.6.4.2, 4.6.5.1, 4.7.4.1, 4.7.5.2.1, 4.7.6.1, 4.7.7.2 *and* 4.7.7.3)

DUMMY/TEST FORK CHARACTERISTICS

G-1 DUMMY/TEST FORK

G-1.1 The test forks shall be designed to mount in a manner similar to the original fork, or in a manner using fork mounting fixture (*see* **F-2**).

G-1.2 The test forks, when mounted, shall be the same length (axle to race), *L*, as the longest fork designed for use with the frame.

G-1.3 The deflection of the test fork shall be measured in the direction of the force application at the front axle center, from the resulting application of a vertical force of 1 200 N. The fork shall be secured in a horizontal position by constraining the steerer tube by means of a false head tube (with bearings) equal to 150 mm in length. The steerer tube shall be secured as in a bicycle with the crown race seat adjacent to the false head tube lower bearing assembly, *see* Fig. 76.

G-1.4 The deflection ratio, D_r, for the test fork for the horizontal loading fatigue test and the vertical loading fatigue test shall not exceed the value of 1,0 when computed as follows:

$$D_r = \frac{k_1 \text{ x } 10\ 000 \text{ x } \delta}{L^3}$$

where

D_r = The deflection ratio;
k_1 = 1 417, a constant;
L = The fork length, expressed in mm; and
δ = The deflection, expressed in mm.

Example:

Fork length L = 460 mm; and

Deflection δ = 6.85 mm, from which deflection ratio D_r

$$= \frac{1417 \text{ x } 10000 \text{ x } 6.85}{460^3}$$

$$= 0.99721 \leq 1.0$$

G-1.5 The deflection ratio, D_r, for the test fork for the impact test shall not exceed the value of 1.0 when computed as follows:

$$D_r = \frac{k_2 \text{ x } 10\ 000 \text{ x } \delta}{L^3}$$

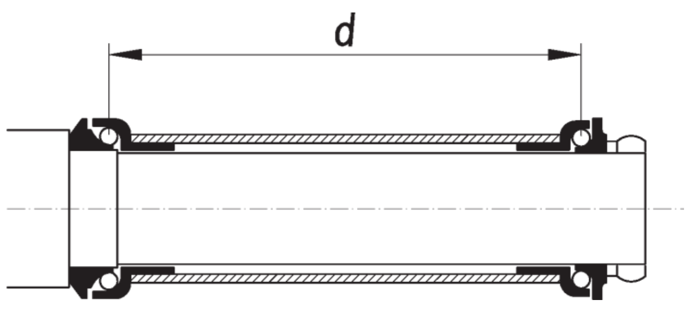
where

D_r = The deflection ratio;
K_2 = 709, a constant;
L = The fork length, expressed in mm; and
δ = The deflection, expressed in mm.

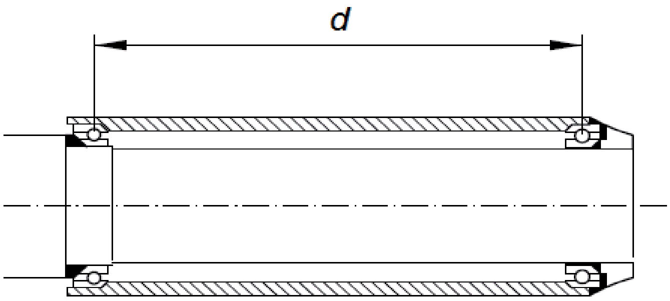
G-2 FORK MOTING FIXTURE

G-2.1 The fork shall be mounted in a fixture representative of the head tube and gripped in the normal head bearings. The distance between the bearings can have an influence on the results. Therefore, when known the real mounting distance shall be used with a tolerance of ±5 mm. If no indication about the distance is given, a value of (150 ± 5) mm shall be taken. The measurement points are taken from the middle of the bearings. Examples of distance measurements are given in Fig. 76.

G-2.2 During loading, the fork steerer will bend and can touch the dummy head tube. The design of the dummy tube shall be such that this contact shall not occur.



a) Measurement with external cup bearing



b) Measurement with integrated bearings

Key

d Distance between the bearings

FIG. 76 EXAMPLES OF DISTANCE MEASUREMENTS

ANNEX H
(*Clauses* 4.6.2.2, 4.7.5.2.1 *and* 4.10.4.1)

VERIFICATION OF FREE-FALL VELOCITY

H-1 For all vertical Impact Tests, the striker shall be guided in such a way that the efficiency will permit to reach at least 95 percent of the free-fall velocity.

The free-fall velocity is calculated using Formula

$$v = \sqrt{2gh}$$

where

v = The free-fall velocity (m/s);
g = The gravitational acceleration (m/s^2) (that is,=9.80665m/s^2); and
h = The falling height (m).

The efficiency is equal to Formula:

$$\mu = (v_i / v) \text{ x } 100$$

where

μ = The efficiency (%); and
v_i = The measured velocity at impact (m/s).

ANNEX J
(*Clause* 4.6.7.1.1)

STRENGTH TEST OF FRAME-FORK ASSEMBLY

J-1 VIBRATION TEST METHOD

J-1.1 With a frame-fork assembly mounted on the stand so as the ground contact points of both intended wheels are horizontal as shown in Fig. 77, test shall be made by application of vertical up and downward vibrations under the conditions given in Table 38. The front wheel attachment shall be freely movable in the lengthwise orientation.

J-1.2 Using a seat pillar to be combined with the frame-fork assembly, fix the seat pillar at the position of the minimum insertion mark. Secure the saddle-shape support as shown in 4 onto the seat area and suspend the circular weights dividedly on both sides through the hanger metals so that the total mass of the weight support, hanger metals, and weights is applied to the seat assembly. The weight support shall be secured to the seat pillar on the axis at 20 mm below the upper extreme of the by a fastening metal. For a frame-fork assembly a combined seat pillar, the test may be performed by replacing the combined seat pillar with a unit pillar having the same If the bar connecting the right-hand and left-hand weights contacts with the battery or other parts, test shall be performed with connecting bar removed. For applying load to the bottom bracket assembly, fix circular weight to the bottom bracket area dividedly on both sides. The weight support to which the weight is fixed shall not be heavier than 2 kg.

J-1.3 For applying load to the head assembly, fix the weight at the position where there is no clearance between the under surface of weight support (of mass not more than 0.5 kg) and the upper surface of the head lock nut by using a metal fitting as shown in (Fig. 77). For a frame-fork assembly using a handlebar stem consisting of a stem only, in which the fork stem is clamped from outside, the test shall be performed with the weight fixed to the upper end of the fork stem by means of a jig which clamps the Fork stem from outside or by means of handlebar stem.

J-1.4 Frequency of vibration shall be selected arbitrarily in the range of 5 Hz to 12 Hz avoiding a resonance.

J-1.5 For testing a frame-fork assembly motor assist cycles, fix the battery, the drive unit, control unit or other that are to be mounted under the test conditions in Table 38, or weights of equivalent masses thereof, on positions where they are actually mounted so that the test assembly simulates the actual application of load on the frame-fork. In this case, the battery, drive unit and control unit themselves are not the subjects of evaluation for the vibration proof performance. When the drive unit housing or other of the frame fork assembly for motor assist cycles constitute a of the frame-fork assembly, the test shall be with all such attached.

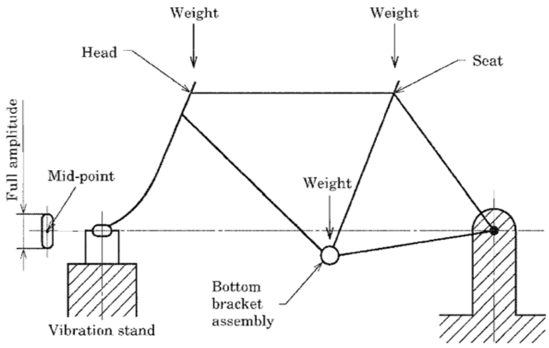


FIG. 77 VIBRATION TEST OF FRAME AND FORK ASSEMBLY

Table 38 Test Condition for Vibration Test of Frame – Fork Assembly
(*Clauses* J-1.1 *and* J-1.5)

			Weight (mass) kg						
Sl No.	**Bicycle Type**		**Head Assembly**	**Seat Assembly**	**Bottom Bracket Assembly**	**Total**	**Frequency Vibration of Part m/s²**	**Acceleration Vibrating**	**Number of Vibrations**
(1)	(2)		(3)	(4)	(5)	(6)	(7)	(8)	(9)
i)	For adults	Diamond - shaped	5	50	20	75	5 to 12	19.6	100 000
		Other shapes	5	45	15	65		17.6	70 000
ii)	MTB - look		10	50	25	85		22	150 000

ANNEX K

(*Clauses* 4.8.3.1 and 4.8.5.1)

WHEEL/TYRE ASSEMBLY — FATIGUE TEST for CITY and TREKKING/ROADSTER /SLR BICYCLES

K-1 TEST REQUIREMENTS

After the test there should be no fractures, detachments, or visible cracks in any part of the wheel, no loss of air pressure in the tyre due to damage from the wheel to the tyre or the inner tube (where fitted), and the undamaged tyre should remain on the Rim.

K-2 TEST METHOD

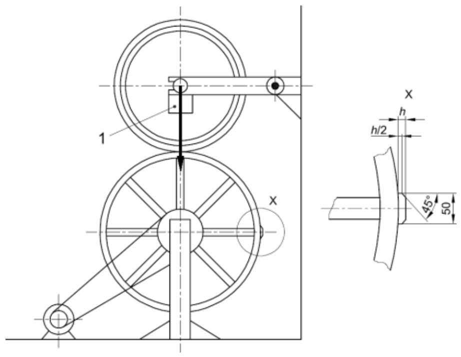
K-2.1 Assemble the wheel, tyre, and inner tube (when fitted) and inflate the tyre to 90 percent of the maximum inflation pressure.

K-2.2 Mount the wheel/tyre assembly free to rotate on its axle, and free to move in a vertical direction. load the wheel assembly by means of dead weights against a drum equipped with equally spaced, transverse, metallic slats such that the radial force applied to the wheel/tyre assembly is 640 N. The wheel and drum axes shall be vertically aligned.

K-2.3 An example of a test arrangement is shown in Fig. 78, in which the wheel axle is fixed between the free ends of a pair of pivoted arms that extend horizontally with the tyre contacting the drum between the slats.

K-2.4 The diameter of the drum shall be in the range of 500 mm to 1 000 mm, and the slats shall have a width of 50 mm ± 2.5 mm, a thickness of 10 mm ± 0.25 mm, and 45° chamfered edges of half their thickness. The circumferential spacing between the center lines of two consecutive slats shall be not less than 400 mm.

K-2.5 Rotate the drum to give a linear surface speed of 25 km/h (± 10 percent) for a period to provide 750 000 impacts between the tyre and the slats.



All dimensions are in millimeter

Key

1 Total force on the axle, 640 N

FIG. 78 WHEEL/TYRE ASSEMBLY — FATIGUE TEST

ANNEX M
(*Clause* 6.2)

STRENGTH TEST FOR STRUCTURAL INTEGRITY OF THE FULLY ASSEMBLED BICYCLE

M-1 TEST REQUIREMENT

There should be no system or component failure and no loosening or misalignment of the saddle, handlebar, controls, lighting equipment, or reflectors, after the test conducted as per **M-2**.

M-2 MACHINE TEST METHOD

M-2.1 Mount a fully assembled bicycle on a test machine. The following weights should be applied:

a) One 36 kg weight with a pin for insertion in the seat-post and divided into two halves to be hung, one on each side;

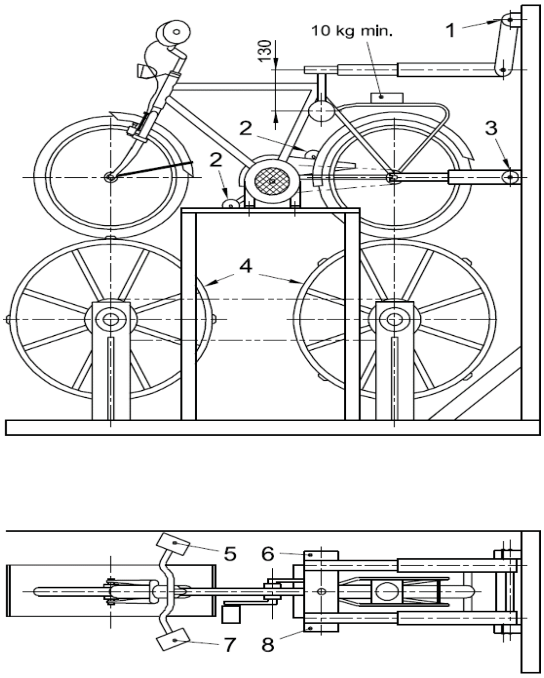
b) Two 18 kg weights with fixtures for attaching them to the cranks in place of the Pedals;

c) Two 6.75 kg weights with fixtures for attaching them to each side of the Handlebar; and

d) One 10 kg, 18 kg, or 25 kg weight with the dimensions 240 mm × 240 mm on the Luggage Carrier.

M-2.2 An example of a test arrangement is shown in Fig. 79, in which the bicycle is mounted on two drums. The diameter of the drums should be in a range from 500 mm to 1 000 mm, and the slots should have a width of 50 mm ± 2.5 mm, a thickness of 10 mm ± 0.25 mm, and 45° chamfered edges of half their thickness. The circumferential spacing between the centerlines of two consecutive slots should be not less than 400 mm.

M-2.3 Rotate the drums to give a linear surface speed of 8 km/h (± 10 percent) for a period of 6 h. The tyres of the bicycle should be inflated to the maximum inflation pressure.



Key

1 Adjustable height;
2 Weight, 18 kg;
3 Height adjustable;
4 Drum diameter, 760 mm;
5 Weight, 6.75 kg;
6 Weight, 18 kg;
7 Weight, 6.75 kg; and
8 Weight, 18 kg.

All Dimensions in millimeters

FIG. 79 DYNAMIC STRENGTH TEST ON A FULLY ASSEMBLED BICYCLE

ANNEX N

(*Foreword*)

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